



ISSN 1562 - 5044

<http://chabjournal.org>

# Chest & Heart Journal

Volume 41    Number 01    January 2017

A Journal  
and  
Official Organ  
of the Chest &  
Heart Association  
of Bangladesh

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# The Chest & Heart Journal

**chabjournal.org**

Publication of The Chest & Heart Association of Bangladesh

Dedicated to Scientific & Professional Development of Pulmonologist & Cardiologist

**ISSN: 1562-5044**

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## ONLINE

<http://chabjournal.org>  
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## PUBLISHED BY:

Editor in Chief  
on behalf of the Chest and Heart  
Association of Bangladesh

## PRINTED BY:

Asian Colour Printing  
130 DIT Extension Road  
Fakirerpool, Dhaka-1000, Bangladesh  
Phone: 49357726, 58313186  
E-mail: asianclr@gmail.com

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## EDITORIAL

# Noninvasive Ventilation (NIV)

*[Chest Heart Journal 2017; 41(1) : 1-2]*

Non invasive ventilation (NIV) refers to the provision of mechanical ventilator assistance without the need for an invasive (endotracheal) airway. Over the last 15 years it is assumed an important role in both acute & chronic forms of respiratory failure<sup>1</sup>.

### Types:

CPAP (continuous positive airway pressure) deliver positive pressure to airway which applies a steady pressure but does not actively assist inhalation.

NIPPV (noninvasive positive pressure ventilation) which consist of a higher pressure during inhalation to actively provide ventilator assistance usually combined with positive end expiratory pressure (PEEP).

### What is BiPAP?

BiPAP is a certain assistance devices which are blower-based units that fluctuate between higher inspiratory pressures and lower expiratory pressure (bilevel) and that have single limb ventilation circuits. Because they have sensitive flow triggers and cycle into expiration in response to decrease in inspiratory flow, they function essentially as pressure support ventilators. With bilevel ventilation, the inspiratory positive airway pressure (IPAP) and expiratory positive airway pressure (EPAP) are absolute pressures and difference between them is the level of pressure support. With critical care ventilators the level of pressure support is added to PEEP. Thus a pressure support of 10 cm of H<sub>2</sub>O and PEEP of 5 cm of H<sub>2</sub>O are equivalent to and IPAP of 15 cm of H<sub>2</sub>O and EPAP of 5 cm of H<sub>2</sub>O.

### NIPPV and its important role:

NIV has theoretical advantages over invasive mechanical ventilation. Intubation traumatizes the upper airway, possibly causing bleeding, vomiting or laceration of the trachea or esophagus, at the same time there needs expert professional and arrangement. The risk of nosocomial infection including health-care associated pneumonia, rises in proportion to the duration of intubation. Intubation is uncomfortable for the patients, requiring sedation and analgesia which add to

potential complication and may slow weaning and extubation. By avoiding these potential complications NIV may improve outcomes by shortening duration of intubation and stays in the ICU and reducing the mortality rates.

### What ventilators are used in NPPV:

Portable pressure limited “Bilevel” ventilators are used for the vast majority of outpatient applications of NPPV. Portable volume limited ventilators may be used as well but these compensate less well for leaks, are heavier and more alarms which becomes a nuisance unless the patient is dependent on mechanical ventilator nearly All time.

Bilevel ventilations have also become popular to deliver NPPV in the acute care setting. Although bilevel device function as well as or even better than critical care ventilators with regard to triggering, cycling and flow delivery, they should not be used for patients with hypoxemic respiratory failure unless equipped with oxygen blenders.

### Indications of NPPV in acute care setting:

NPPV more rapidly improves vital signs and gas exchange and avoids the intubation compared to conventional therapy in patient with respiratory failure due to COPD exacerbation or acute cardiogenic pulmonary oedema or in association with immunocompromised status. In these patient NPPV should be considered the ventilator modality of first choice unless there are contraindications<sup>2</sup>. The use of NPPV in a variety of other forms of respiratory failure including Asthma, severe Community-Acquired Pneumonia occurring in the COPD patient or in the post operative setting after lung resection and hypoxemic respiratory failure.

### NPPV should not be used:

NPPV should not be advised in case of acute deterioration in the end stage of interstitial fibrosis, sever ARDS with multiple organ dysfunction syndrome, post operative upper airway or esophageal surgery, upper airway obstruction with a high risk for occlusion.

**Predictors of NPPV failure:**

Advanced age, greater acuity of illness (a new simplified physiology score [SAPS II]>29), inability to cooperate (GCSd<sup>11</sup>), inability to coordinate breathing with ventilator, air leaking from lack of dentition, severe hypercarbia ( $P_{CO_2}$ >92 mm of Hg), acidemia (pH<7.25), failure to improve gas exchange, pH and heart and respiratory rates within first 2 hours.

**How to initiate NPPV in acute respiratory failure:**

NPPV in acute respiratory failure is initiated by a mask that fits properly and comfortable for the patient. Connect the mask to the ventilator initially at low pressure (8-12 cm of H<sub>2</sub>O inspiratory and 4-5 cm of H<sub>2</sub>O expiratory) to facilitate adaptation. With volume limited modes a tidal volume 10-15 ml/kg is used. Oxygen supplementation through either an oxygen blender or a tube attached to mask or ventilator circuit should be adjusted to maintain a target saturation >90-92%<sup>3</sup>. The difference between the inspiratory and the expiratory pressure is the pressure support and because this pressure is responsible for decreasing respiratory distress and facilitating the elimination of CO<sub>2</sub>, the inspiratory pressure should be increased or tolerated, usually to pressure between 12 cm of H<sub>2</sub>O and 20 cm of H<sub>2</sub>O. The expiratory pressure can be increased (usually to a maximum of 8 cm H<sub>2</sub>O) to facilitate triggering in patient with auto-PEEP or to treat hypoxemia.

**Monitoring of patients on NPPV:**

Patients started on NPPV in the acute setting require close monitoring, as dictated by the acuity of their illness. Subjective responses are important initially, particularly comfort and respiratory distress. Respiratory rate and sternocleidomastoid muscle activity should be diminishing and abdominal paradox should be abolished. Oximetry should be monitored continuously at first and blood gases should be obtained periodically (usually within the first hour or two and then as clinically indicated to ascertain changes in PaCO<sub>2</sub>).

**When NPPV can be discontinued?**

Patient stabilization as indicated by adequate oxygenation (O<sub>2</sub> saturation >90% on FiO<sub>2</sub> d<sup>11</sup> 40% or equivalent; expiratory pressure ≤5 cm of H<sub>2</sub>O) and amelioration of respiratory distress (Respiratory rate ≤24/min) during ventilator use. The patient is then removed from assisted ventilation and is observed while breathing supplemental O<sub>2</sub> as needed. Patient who developed increasing inspiratory distress or deterioration of gas exchange are

placed back on NPPV at the previous settings and are allowed to rest for few hours with weaning tried again periodically.

**Indications of NPPV in chronic respiratory failure:**

NPPV is indicated when symptomatic nocturnal hypoventilation develops in wide variety of slowly progressive neuromuscular disorders such as limb girdle muscular dystrophy, post polio syndrome and multiple sclerosis<sup>4</sup>. Ideally assisted ventilation is started before the development of day time hypercapnia to better control of symptoms and to minimize the likelihood of a respiratory crisis before the patient can adequately adapt to NPPV. When FVC<50% of predicted or when maximal inspiratory pressure is below 60 cm of H<sub>2</sub>O even in absence of symptoms also permit initiation of NPPV. Patient with severe kyphoscoliosis or central hypoventilation are also good candidates. Obstructive sleep apnea with hypoventilation or obesity-hypoventilation are also good candidates.


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## ORIGINAL ARTICLE

# Liquid Biopsy: A New Era in Lung Cancer Management

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Md. Jamal Uddin<sup>7</sup>

### Abstract:

*Cancer is associated with multiple genetic mutations and analysis of these is increasingly used for management. Mainly histopathological examination of biopsy specimen is used for decision but sometimes biopsy specimen cannot be available due to invasive nature of surgical procedures and inaccessible tumor site. However tumors are highly heterogeneous and evolve over time and can alter their molecular genotype making clinical decisions based on historical biopsy data suboptimal. Tumor cells release circulating free DNA (cfDNA) in blood. This can help to detect genetic aberration. A liquid biopsy can provide information's from blood samples or body fluids and it is non-invasive. It can help to screen, diagnose and treatment in a personalized way and also detect mutations over time.*

**Key words:** Cancer, DNA, liquid biopsy.

[Chest Heart Journal 2017; 41(1) : 3-7]

### Introduction:

Biopsies have been used by clinicians to diagnose and manage disease for 1000 years<sup>1</sup>.

The science of non invasive disease monitoring has advanced greatly since circulating cell free DNA (cfDNA) was first reported in body fluids by mantle and Metais<sup>2</sup>.

Since then, the evolution of sensitive cfDNA detection technologies has enabled the development of liquid especially in oncology, Liquid biopsy allows for patient stratification, screening, monitoring treatment response and detection of residual disease or recurrence.

Malignant cells are heterogeneous in behavior. Liquid biopsies have grown in importance become the genetic profile of tumors can affect how they will respond to a certain treatment. There is also limitation of detection of single snap shot of the tumor-. This single biopsy bias was highlighted in a study by Gerlinger et al<sup>3</sup>.

It was found that there is marked intratumoral and intertumoral evolution when biopsies where taken from different parts of a primary tumors and its metastases. But there are many difficulties in obtaining a tissue biopsies as many as 3% of cases

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**Submission on:** 12 Nov. 2016,

**Accepted for Publication:** 25 Jan. 2017

Available at <http://www.chabjournal.org>

do not have accessible tissue<sup>4</sup>. The hazards are discomfort of the patient, clinical risk to the patient, potential surgical complications and economic consideration. All the tumors may not be accessible for biopsy. Even biopsy procedure may cause seeding cancer to other sites<sup>5</sup>.

In 1948, circulating free DNA (cfDNA) detection was the first step toward liquid biopsy<sup>2</sup>. It was also found that cfDNA levels were higher in patients than the healthy individuals. So it can be used for screening the disease through a simple blood test<sup>6</sup>. The heterogeneous landscape of the tumor was also possible to be detected by using a blood sample<sup>7</sup>.

Where a tissue sample was taken for biopsy it only informed the genotype at that particular point but it is known that tumors are very dynamic and change their dominant mutation pattern or may acquire new mutations. This is particularly unfavorable when stratifying patients to a specific targeted therapy.

Approximately 50% of NSCLC patients become resistant to tyrosine kinase inhibitor therapy though an epidermal growth factor receptor (EGFR) T790M mutations<sup>8,9</sup> whereas only <5% of NSCLC patients have this mutations detectable in the primary biopsy<sup>10</sup>. So liquid biopsy helps in early diagnosis of cancer by cfDNA assessment<sup>11,12</sup> and also tumor-associated genetic alterations can be detected that will help in the assessment of prognosis, early detection of disease recurrence and predicting response to particular treatment.

### **How to perform the liquid biopsy**

Presently the most commonly used protocols to obtain cfDNA requires approximately 1 ml of serum or plasma (3 ml of blood) and preparation should not exceed 4-5 hours following the blood draw. For plasma preparation, blood must be collected in a tube treated with an anticoagulant preferably EDTA (ethylene diamine tetra acetic acid). Cells are then removed by centrifugation and the supernatant or plasma is removed<sup>13</sup>. Serum is collected after the blood is allowed to clot and following centrifugation is the supernatant or serum is removed<sup>14</sup>. Circulating DNA is then extracted from the plasma or serum using commercially available kits.

A portion cfDNA is derived directly from the tumor (ctDNA) also from circulating tumors cells (CTC) and this fraction can be quantified<sup>15,16</sup>.

Furthermore, and in vivo study has shown a direct correlation between tumor burden and the quantity of ct DNA released.<sup>17</sup> The fraction of circulating DNA that is derived from the tumors can range between 0.01% and 93%<sup>18,19</sup>.

Techniques are available for reliable monitoring of tumour-associated genetic aberrations including somatic mutations, loss of heterozygosity and chromosomal aberrations in the blood<sup>20</sup>.

### **Use of liquid biopsy**

Assessment of prognosis:

Assessing prognosis for an individual patient involves a combination of clinical observations staging, and histopathology of different tumor types. In this context liquid biopsy may be useful in circumstances where a tissue biopsy is not available or genetic analysis of archived tumor samples is not possible<sup>21</sup>.

Studies have shown that there is a statistically significant correlation between disease stage and the presence of tumor associated genetic aberrations in the blood of patients with different cancers like breast, pancreatic, colorectal and oral squamous cell carcinoma<sup>22</sup>.

The presence of tumor-associated genetic aberrations including tp53 mutations and loss of heterozygosity, correlated with overall survival or disease-free survival.

Liquid biopsy is much more useful in patient with unrespectable advanced stage disease. In a multi variant analysis, KRAS mutations present in the plasma of 246 patients with advance stage NSCLC was shown to predict poor prognosis in patient receiving first line chemotherapy<sup>23</sup>.

### **Detection of recurrence:**

A promising clinical implicating of liquid biopsy is the early detection of relapse after potentially



curative treatment. After treatment with curative intention, patients are monitored for signs of residual disease and local or distant recurrence using radiological image during post treatment follow-up<sup>24-26</sup>.

But the disadvantage of these techniques is cost, requiring contrast media (exposing patient to doses of radiation) and control be used for frequent monitoring. It also has limited sensitivity for the detection of micrometastases<sup>27,28</sup>.

In a land mark paper Diehl et al. showed that by monitoring tumor specific aberrations (including APC, TP. 53, KRAS) in the plasma of patients it was possible to identify disease recurrence with almost 100% sensitivity and specificity. Patients with residual diseases were also identified based on the. Persistence of tumor associated genetic aberration in cfDNA immediately after surgery.

#### **Difficult-to-diagnose cancers:**

Liquid biopsies can be used to assist in the clinical management of difficult-to-diagnose patients with advanced stage cancer, as in the case of bone metastases. For example, in a study in which targeted deep sequencing of cancer-related genes (including TP53, PIK3CA and KRAS) was carried out on cfDNA in a patient who had previously undergone surgery to resect synchronous cancers of the bowel and ovary, it was shown that on relapse the metastases was derived from the original ovarian cancer (owing to the presence of a R273H TP53 mutation). A biopsy in this case was not possible and had the information derived from cfDNA been available immediately unnecessary delay or uncertainty over treatments might have been avoided.

#### **Prediction of response to treatment:**

The presence or absence of a single genetic alteration in tumor DNA is currently employed to guide clinical decision making for a number of targeted agents, for example EGFR mutations for gefitinib in NSCLC; ALK rearrangements for crizotinib in NSCLC<sup>29</sup>. Targeted agents are often used or tested in patients with advanced-stage disease having multiple metastases. Sometimes a new biopsy

cannot be obtained and ctDNA might provide superior molecular information compared to archival tissue DNA for determining the current cancer molecular status. A liquid biopsy could obviate the need for tumor tissue DNA in metastatic patients.

#### **Conclusion:**

Cancer is a complex and dynamic disease that can change quickly. To fully deliver on the promise of personalized medicine, development of reliable and robust non-invasive platforms for the diagnosis, patient stratification and to monitor treatment response are paramount. Although liquid biopsies have a great potential, many hurdles must be overcome before proceeding to the clinic. The various liquid biopsy platforms described in this review have the potential to add tremendous value to the care of cancer patients.

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## ORIGINAL ARTICLE

# Multi-Drug Resistant Tuberculosis: Illness perception of patients during and after treatment

Kazi Shafiqul Halim<sup>1</sup>, Md. Abu Raihan<sup>2</sup>, Fatema Nargis<sup>3</sup>, Farjana Jahan<sup>4</sup>,  
Tapose Bose<sup>5</sup>, Mostofa Kamal Rouf<sup>6</sup>

### Abstract:

**Background:** Includes fifteen percent of Multi-drug resistant tuberculosis (MDR-TB) cases; Bangladesh ranked sixth globally. MDR-TB patients have a high baseline incidence of depression and anxiety. MDR-TB drugs may exacerbate psychological problems which may lead to psychiatric disorder. Psychiatric disorder that may hamper level of illness perception of MDR-TB patients had been addressed.

**Objective:** To determine the level of illness perception among Multi-drug resistant tuberculosis patients during and after treatment.

**Materials and Methods:** During January to June 2013, the cross-sectional study was conducted at health facilities under National Tuberculosis Control program (NTP). Study subjects: 1. Record review- (a) at NTP for assessment of monthly report (March 2013) to find out recently cured cases and (b) at Health Facilities for reviewing laboratory register, treatment register and discharge register for conformation and identification cases and 2. MDR-TB Patients- to assess their illness perception. Irrespective of sex only adult (>18yrs) confirmed MDR-TB cases those were diagnosed and treated under NTP were interviewed.

**Result:** A total of 324 MDR-TB patients (302 during and 22 after the treatment) were included. Regarding the casual belief of the patients, 18 causes were offered for yes or no responses; three important responses were taken from each patient for the analysis. Most of the patients (69%) believed that germ causes their disease. Nearly half (46%), 39%, 35%, 31%, 17%, 17%, 16% and 15% believed that bad luck, nutritional factors, immune deficiency, environmental pollution, overwork, heredity, smoking and inappropriate treatment were responsible for developing MDR-TB respectively. Total nine causes were found attributable by the patients. About consequences, personal control, treatment control, illness coherence and emotional representations subscales, study revealed that 68%, 71%, 51%, 44% and 60% of the patients had "good level" of perception respectively; where 68% had "average level" about the identity of MDR-TB; additionally "poor level" of perception was found about the timeline (acute/chronic) and 'timeline cyclical' subscale, i.e., 62% and 58% respectively. Summation of all the subscale scores for overall perception about MDR-TB revealed the majority (56%) had average, 30% had poor and 14% had good level of perception. Perception level is higher among relatively older patients aged 50 years and above; but it falls after this age.

**Conclusion:** Psychiatric medications, individual counseling, emotional support, group therapy may be required in order to achieve a better level of illness perception in MDR-TB patients. Multi-way approaches like social, mental and educational interventions should be considered.

**Key words:** MDR-TB, Illness Perception.

[Chest Heart Journal 2017; 41(1) : 8-17]

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**Submission on:** 15 Oct. 2016,

**Accepted for Publication:** 25 Jan. 2017;

Available at <http://www.chabjournal.org>

**Introduction:**

MDR-TB is a growing public health problem in the world as well as in Bangladesh. MDR-TB threatens effective treatment and undermines global efforts towards elimination of TB<sup>1</sup>. Includes 15% of MDR-TB cases; Bangladesh ranked sixth among the world's high-burden TB countries. MDR-TB patients have a high baseline incidence of depression and anxiety, often connected to disease duration and socio-economic stressors. MDR-TB drugs may exacerbate psychological problems and any psychiatric illness identified at the start of or during treatment should be addressed fully<sup>2</sup>. Anti-tuberculosis drug resistance develops when the medications are taken inconsistently, either due to health system failures or poor treatment adherence<sup>3</sup>.

Patients with MDR-TB face the prospect of lengthy and often unpleasant treatment as well as the real possibility of premature death. Therefore, counseling and emotional support are particularly important, much as in any other chronic life-threatening illness<sup>4</sup>. Illness perceptions directly influence the individual's emotional response to the illness and their coping behavior such as adherence to treatment. As adherence to treatment is crucial to prevent MDR-TB, measuring illness perception is important. Negative illness perceptions are associated with increased future disability and a slower recovery. New interventions based on such studies have the potential to improve patient outcomes<sup>5</sup>.

MDR-TB patients have a high baseline incidence of depression and anxiety, often connected to disease duration and socio-economic stressors. MDR-TB drugs may exacerbate psychological problems and any psychiatric illness identified at the start of or during treatment should be addressed fully. Psychiatric medications, individual counseling, and/or group therapy may be needed. Systems should be in place for psychiatric emergencies including psychosis, suicidal indication, and any situation that involves the patient posing a danger to him/her or to others<sup>6</sup>.

Beyond side effects, several psychosocial factors also challenge the ability of patients to adhere to treatment. The majority of patients live in poverty and the disease puts a further strain on their families. Due to the multiple, complex difficulties faced by patients, the development of successful strategies to support patients is essential to ensure treatment adherence and,

consequently, to effectively control the MDR-TB epidemic<sup>7</sup>.

In the best MDR-TB treatment programs cure rate average about 60%, with the only prospect of improvement (using currently available regimens) being achieved through more effective delivery programs<sup>8, 9</sup>. Cure rates are lower in the presence of XDR-TB or untreated HIV co-infection<sup>10</sup>. TB and MDR-TB treatments impacted on patients' self-perceived health status. This effect diminished after successful treatment<sup>4</sup>.

**Materials and Methods:**

During the period of 1st January to 30th June 2013, the cross-sectional both qualitative and quantitative study was conducted at tertiary level of Government health facilities (i) National Institute of Diseases of the Chest and Hospital (NIDCH), Dhaka (ii) Chest Disease Hospital (CDH), Chittagong and (iii) Chest Disease Hospital (CDH), Rajshahi. At these three facilities MDR-TB cases are available for management and treatment under National Tuberculosis Control program (NTP). Study subjects were: 1. Record review- (a) at NTP office for assessment of monthly, quarterly & annual report to find out existing/ recently (within one month) cured MDR-TB cases and (b) at above three health facilities for reviewing patient's register, admission register, patient card, laboratory register, treatment register and discharge register for conformation and identification of MDR-TB cases and 2. MDR-TB Patients- those were admitted into and recently cured cases those were received treatment from above three health facilities to assess their illness perception. Irrespective of sex only adult (>18yrs) confirmed MDR-TB cases those were diagnosed and treated under National Tuberculosis Control Programme (NTP) were interviewed.

The sample size was calculated by using commonly used for representative sample for proportions [Yielding from Cochran (1963:75) Equation], then for the small population (Out of total TB cases only 2,100 were MDR-TB cases during study period) of MDR TB patients, the sample size were being adjusted (called the finite population correction) for substantially reduce the necessary sample size for small populations. MDR-TB cases were included in the study

randomly from above three health facilities and previously treated cases from these facilities were enlisted by collecting information from patient's registrar and/or treatment register at the source. Random sampling technique was used for selection of the MDR-TB cases from those Facilities. Three lists of MDR-TB cases from the three Government TB facilities, one list from each facility was made by reviewing the upgraded annual report of NTP and other valid sources in Bangladesh. Rational proportion of MDR-TB cases from three lists were selected randomly. Data were collected by i) reviewing patient documents like laboratory register, treatment register, admission register, quarterly report and patient card to enlist the distribution of total MDR-TB cases of Bangladesh ii) laboratory investigations like sputum for AFB, X-ray chest and confirmatory test for MDR-TB (Gene Xpert, PCR) for identification of confirmed MDR-TB cases and iii) data related to illness perception (regarding the casual belief) and socio-demographic data were collected by interviewing patients.

The collected data were analyzed by computer using SPSS (version 20.2). Descriptive statistics was included univariate and multivariate analysis. Relevant statistical tools were used to compare the study findings with findings of the National TB control programme and to compare with the achievements of programme. Descriptive part of the study was presented as statistics of mean, frequency, SD of collated data. Analytical part of this study has been done by various statistical tests. Furthermore factors influencing perception of MDR-TB patients were explored.

### **Ethical Implications:**

The study was conducted maintaining all possible ethical considerations. Informed written/verbal consent of the patients and providers were obtained before data collection. Informed consent form was contained purpose, methods and benefits of the study. Both consent taking and interview was conducted in local language, Bengali. During interview, all sorts of privacy of the patients and providers were maintained. Ethical clearance was obtained from the Ethical Committee of BMRC.

### **Results:**

In this study, mean ( $\pm$ SD) age of the patients was 32.46 ( $\pm$ 11.25) years with the range from 18 to 60 years. Nearly half of the patients (44.3%) were between 30 and 39 years aged and more than one third (37.6) of the patients were between 40 to 49 years of age. Only 10.9% were 50 years above. It was found that, level of education; more than one-third (37.4%) were primary level, more than one-fourth (26.1%) were illiterate, 22.2% were secondary, 5.5% were graduate and above.

About one-third (32.5%) patients were day laborer/farmers, 24.9% were housewives, 21.4% were service holders, 12.1% were business person & 9.1% were students. More than two-third (69%) female patients were housewives and rest of them were others occupations. Regarding patient's religion, there were 293 (90.5%) Muslims and 31 (9.5%) Hindus.

In this study, most of the (71.8%) patients were married and almost all (91%) patients came from nuclear family and only 31 (9%) came from joint type family. Regarding family size, highest proportion (45.3%) patients had 5 to 7 family members, 40.4% had 2 to 4 family members and rest of them had 8 to 12 family members. Mean of family members is 5.2 ( $\pm$ 2).

The average monthly family income of the patients was Tk. 18, 1113 ( $\pm$ 5576). Most of the (88%) 284 patients' monthly income was between Tk. 11, 000 and 20, 000. Another 30 (9%) patients' income was between Tk. 5000 and 10000. Only 10 (3%) patients' income was between Tk. 31, 000 and 40, 000.

Regarding type of house of the patients, it was observed that, majority 159 (49%) of them lived in 'Kancha' house. More than one fourth 85 (26%) of them lived in tin made house. Another 34 (10%) of them lived in 'Packa' house and 46 (14%) of them lived in semi 'Packa' house.

Regarding the duration of MDR-TB, it is revealed that, the highest number of MDR-TB patients (30%) were within 6 to 30 days duration, 26.5% patients' duration of illness was between 181 to 360 days. Duration of illness was between 91 to

180 days among 16.5% cases. 17% patients' duration of disease was between 31 and 90 days and 10% patients' duration of disease was above 360 days. Average duration of illness was 158.07 (+\_152.56). Range of duration of illness was 6 to 900 days.

Table- I shows the casual belief of the patients, 18 causes were offered for yes or no responses; three important responses were taken from each patient for the analysis. Most of the patients 225 (69.1%) believe germ is the causes of their disease, 99 (30.9%) of them believe that environmental pollution or unhygienic environment is responsible for it, 46.3% blamed their bad luck, 38.6% blamed food habit or nutritional factors, 35% blamed immune deficiency, 17% believe that heredity is a cause, another 15% blamed inappropriate treatment or poor medical care in the past, 17% blamed overwork or excessive labor and 16.1% blamed smoking as a cause behind developing MDR-TB. Total nine causes were found attributable by the patients. Other nine causes were believed to be non-relevant by them. All 324 patients responded in the section three responses were taken from each patient. The study revealed significant association between sex of the patients and smoking attribution. The following table is showing the scenario.

Table II shows the Multiple Responses (3 responses from each patient) regarding the level

of perception about the identity of the patients' disease, 68% had average level of perception. Regarding the level of perception about the timeline (acute/chronic) and 'timeline cyclical' subscale 62.35% and 57.5% of them had poor level of perception respectively. Regarding the level of perception in the subscale of consequences, personal control, treatment control, illness coherence and emotional representations of the patients' disease, it was found that 68.0%, 70.8%, 50.9%, 44.4% and 59.8% of the patients have good level of perception respectively.

Table III shows the major findings of all subscales at a glance. It is revealed that, in the illness identity subscale, majority of the patients (50.8%) had average level of perception; in the timeline (acute/chronic) subscale, 65.9% of the patients believed that the illness will not last long; in the consequences subscale, most of the 60.1% patients believed that the disease was a serious one; in case of personal control subscale, most (75.8%) of the patients believed that they can influence or control the disease and its outcome. In treatment control subscale, half of the patients (55.9%) had faith on the current treatment. Illness coherence subscale showed that 44.3% patients believed that they could clearly understand the disease. Timeline cyclical subscale revealed, 53.5% of the patients believed that the symptoms were not cyclical in nature. Emotional representation subscale showed, 65.9% of the patients were psychologically upset

**Table-I**  
*Patients' belief about the causative factors of their MDR-TB*

Causal belief	Responses		Percent of cases
	N	percent	
Heredity attribution	15	4.7%	17.0%
Germ attribution	73	22.7%	69.1%
Food habit attribution	49	14.5%	38.6%
Bad luck attribution	50	15.7%	46.3%
Poor medical care in the past attribution	11	2.6%	15.0%
Pollution of environment attribution	47	14.0%	30.9%
Overwork attribution	18	6.3%	17.0%
Smoking attribution	20	6.5%	16.1%
Altered immunity attribution	41	13.0%	35.0%
Total	324X3	100%	(100X3)%

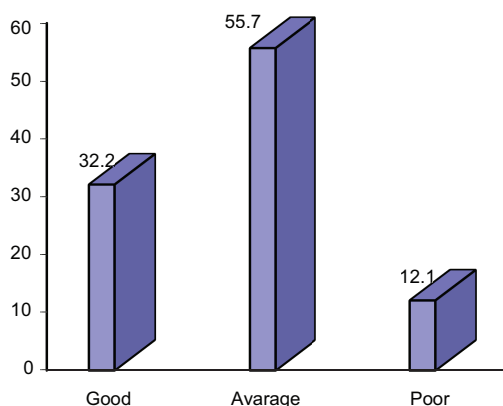
**Table-II**  
*Patients Perception about MDR-TB*

Characteristics	Perception Level	Frequency	Percent
Patients perception about the identity of other MDR-TB	Poor	82	25.4
	Average	220	68
	Good	22	6.7
Patients' perception about timeline (acute/chronic) of their MDR-TB	Poor	202	62.35
	Average	92	28.4
	Good	30	9.25
Patients' perception about the consequences of MDR-TB	Poor	58	18
	Average	45	14
	Good	221	68
Patients' perception about the personal control of their MDR-TB	Poor	3	0.9
	Average	92	28.3
	Good	229	70.8
Patients perception about the treatment control of their MDR-TB	Poor	18	5.7
	Average	141	43.4
	Good	165	50.9
Patients' perception about the illness coherence of their MDR-TB	Poor	71	21.8
	Average	109	33.8
	Good	144	44.4
Patients' perception about the timeline cyclical of their MDR-TB	Poor	186	57.5
	Average	98	30.2
	Good	40	12.3
Patients' perception about the Emotional Representation of their MDR-TB	Poor	36	11
	Average	94	29.2
	Good	194	59.8

**Table-III**  
*Major findings of all subscales at a glance*

Subscale	Major findings & their interpretations
Illness identity	50.8% patients have average level of perception regarding illness identity
Timeline (acute/chronic)	65.9% patients believe that the illness will not last long (poor)
Consequences	60.1% patients believe that the disease is a serious one (good)
Personal control	75.8% patients believe that they can influence or control the disease (good)
Treatment control	55.9% patients have faith on the current treatment. (good)
Illness coherence	44.3% patients believe that they can clearly understand the disease. (good)
Timeline cyclical	53.5% patients believe that the symptoms are not cyclical in nature
Emotional representations	65.9% patients are psychologically upset about the disease. (good)





**Fig-I:** Patients' perception about their MDR-TB disease.

about their disease. The following table shows the major findings and their interpretation of all the subscales.

It is observed that the 55.7% of the patients had average level of perception in the overall illness perception scale. Figure-I below shows the level of overall perception regarding MDR-TB

Association was tested between perception regarding MDR-TB and sex, religion, marital status, house-type, treatment taken before the start of anti-TB therapy, age, family income; but no statistically significant association was noted.

### Discussion:

This cross-sectional study was conducted at National Institute of Diseases of the Chest & Hospital, Mohakhali, Dhaka from January to June 2013. The main objective of this study was to assess the level of illness perception among MDR-TB patients and to identify socio-demographic characteristics of them. It assessed the level of illness perception in terms of illness identity, timeline-acute/chronic, consequences, personal control, treatment control, illness-coherence, timeline-cyclical & emotional representations. It also assessed the patients' belief about the causative factors of MDR-TB.

A total of 324 MDR-TB patients (302 during and 22 after the treatment) were enrolled in this study. Mean age of the patients was 33.46 (+\_11.25) years with the range from 18 to 60 years. Nearly half of the patients (44.3%) were between 30 and 39 years aged and more than

one third (37.6) of the patients were between 40 to 49 years of age. Only 10.9% were 50 years above. It was found that, level of education; more than one-third (37.4%) were primary level, more than one-fourth (26.1%) were illiterate, 22.2% were secondary, 5.5% were graduate and above.

A study was conducted in Pakistan by Mohammed O Husain, Sam P Dearman, Imran B Chaudhry, Nadeem Rizvi and Waouas Waheed on The relationship between anxiety, depression and illness perception in tuberculosis patients' found mean age was 37.3 years which is almost similar with the study. Another study was conducted in London by K. E. Nnoaham, R. Pool, G. Bothamley & A. D. Grant on Perceptions and experiences of tuberculosis among African patients attending a tuberculosis clinic in London- in which mean age was 33.81 years, which is also similar to this study. In this study 65.1% patients were male and 34.9% patients' were female. A study was conducted in London where 62.5% were male and 37.5% were female which is almost similar with this study. Another study was conducted in Pakistan where 20.4% were male and 79.6% were female. From the study it was found that, level of education were 32.1% primary, 27.4% illiterate, 22.6% secondary, 10.4% higher secondary, 4.7% graduate and 2.8% masters. A study was conducted in Rawalpindi, Pakistan by Muhammad Khurram, Hamama Tui Bushra K. haar, Muhammad Fahim on MDR-TB in which 60% patients were illiterate.

In this study, about one-third (32.5%) patients were day laborer/farmers, 24.9% were housewives, 21.4% were service holders, 12.1% were business person & 9.1% were students. More than two-third (69%) female patients were housewives and rest of them were others occupations. Bangladesh is a Muslim dominant country and it was reflected in this study showing there were 293 (90.5%) Muslims and 31 (9.5%) Hindus. A study was conducted in Rawalpindi, Pakistan in which 60% patients were employed 1321. Another study was conducted in Pakistan by Mohammed O Husain, Sam P Dearman, Imran B Chaudhry, Nadeem Rizvi and Waquas Waheed on The relationship between anxiety, depression and illness perception in tuberculosis patients' in which majority of the

sample (79.6%) were unemployed. A study was conducted in southeast Ethiopia by GamedaAbebe et al in which Muslims were predominant (90.5%).

In this study, most of the (71.8%) patients were married and almost all (91%) patients came from nuclear family and only 31 (9%) came from joint type family. Regarding family size, highest proportion (45.3%) patients had 5 to 7 family members, 40.4% had 2 to 4 family members and rest of them had 8 to 12 family members. Mean of family members is 5.2 (+\_2). A study was conducted in Pakistan by Mohammed O Husain et al on The relationship between anxiety, depression and illness perception in tuberculosis patients' in which 58.3% subjects were married. 35.2% single, 5.6% widowed and 0.9% divorced. Another study was conducted in southeast Ethiopia by GamedaAbebe et al in which married individuals were 72.9%<sup>12</sup> which is similar to this study. A study was conducted in Rawalpindi, Pakistan by Muhammad Khurra.m, liamama Tut BushraKhaar, Muhammad Fahim on MDR-TB in which 73.3% patients were from overcrowded residences. A study was conducted in Rawalpindi, Pakistan by Muhammad Khurram at el about MDR-TB in which 73.3% patients were from overcrowded residences.

The average monthly family income of the patients was Tk. 19, 220 (+5655). Most of the (88%) 284 patients' monthly income was between Tk. 11, 000 and 20, 000. Another 30 (9 %) patients' income was between Tk. 5000 and 10000. Only 10 (3%) patients' income was between Tk. 31, 000 and 40, 000. A study was conducted in Rawalpindi, Pakistan by Muhammad Khurram at el<sup>11</sup> about MDR-TB in which patients had a monthly income of less than 5000 Pakistani Rupees (42 Euro) per month . To evaluate the epidemiological status of Tuberculosis regarding to the socioeconomic characteristics between 1995 and 2004 a study was performed. From the study it was found that TB prevalence was higher in the poor socioeconomic condition. In another study it was found that most TB patients were from low-income families which were similar to this study.

Regarding type of house type of the patients, it was observed that, majority 159 (49%) of them

lived in 'Kancha' house. More than one fourth 85 (26 %) of them lived in tin made house. Another 34 (10%) of them lived in 'Packa' house and 46 (14%) of them lived in semi 'Packa' house. As we know, poor socio-economic condition is an established factor behind occurrence of TB, all available literatures show almost same picture. Type or housing, is directly related to socio-economic condition. Especially moist or damp condition of houses is strongly related to developing TB.

Regarding the duration of MDR-TB, it is revealed that, the highest number of MDR-TB patients (30 %) were within 6 to 30 days duration, 26.5% patients' duration of illness was between 181 to 360 days. Duration of illness was between 91 to 180 days among 16.5% cases. 17% patients' duration of disease was between 31 and 90 days and 10% patients' duration of disease was above 360 days. Average duration of illness was 158.07 (+\_152.56). Range of duration of illness was 6 to 900 days.

Duration of treatment against MDR-TB was same as their duration of disease (MDR-TB). No patient was found to be a primary MDR case. Rather all were previously treated as 'usual TB' and when the usual treatment regimen failed then they were diagnosed as MDR.

From this study it was found that, more than half of the patients (54.4%) received allopathic treatment before starting anti-TB therapy. There were 20.2% patients who received treatment from quack doctors, 9.0% took herbal/traditional treatment, 8.0% took homeopathic treatment and 8.4% took no treatment before starting anti-TB therapy. It seems access to allopathic treatment is getting easier to the patients of Bangladesh. Quack doctors are at the second leading position which reflects the actual scenario of this country regarding treatment seeking behavior.

Causal belief builds up on the basis of level of information gathered by the patients from their educational and socio-economic backgrounds and spiritual thoughts. In this study, to find out the causal belief of the patients, eighteen causes were offered for yes or no responses; three most important responses were taken from each patient for the analysis. Most of the patients

225 (69.1%) believe germ is the causes of their disease, 99 (30.9%) of them believe that environmental pollution or unhygienic environment is responsible for it, 46.3% blamed their bad luck, 38.6% blamed food habit or nutritional factors, 35% blamed immune deficiency, 17% believe that heredity is a cause, another 15% blamed inappropriate treatment or poor medical care in the past, 17% blamed overwork or excessive labor and 16.1% blamed smoking as a cause behind developing MDR-TB<sup>12</sup>. Total nine causes were found attributable by the patients. Other nine causes were believed to be non-relevant by them. In this study we found the association between sex of the patient and smoking attribution. More male patients think that smoking is a cause of MDR-TB and fewer female patients think so. This association is significant as the p value is 0.04. A study was conducted in Romania by Man Milena Adina et al on 'Depressive syndrome, anxiety and illness perception in Tuberculosis patients' found the main causes of disease perceived by patients were: smoking (n=26), untreated cold (n=25), alcohol abuse (N=12), physical fatigue (N=12), microbe (N=12), stress (N=9), occupational hazards (N=8), own behavior negligence (N=8), diet (N=7), poverty (N=7), cold (N= 7).

In this study, regarding the level of perception about the identity of the patients' disease, it is found that the majority 68% of the patients had average level of perception, 6.6% patients had good level of perception and 25.4% patients have poor level of perception. This subscale was modified after the published guideline for the IPQ-R. Eight most common symptoms of TB were asked to the patient with yes or no options in order to find out the belief of the patients about whether these are related to his/her disease or not. Most of them successfully correlated the major symptoms with their MDR-TB.

Perception of timeline (acute/chronic) is a subscale for measuring the belief of the patients about the duration of his/her illness. In this study it is found that, regarding the level of perception about the timeline (acute/chronic) of the patients' disease, the majority (62.35%) of the patients had poor level of perception, 28.40% patients

have average level of perception and only 9.5% patients have good level of perception. This means, majority of them think that, their illness will not last long.

Perception about 'illness consequences is a subscale which measures the patients' belief about the severity or destructibility of the disease. In this study we found, the majority (68%) of the patients have good level of perception. 18% patients had poor level of perception and 14% patients had average level of perception about illness-consequences. This means, majority of the patients believe that MDR-TB is a serious disease and it has bad consequences on life.

Personal control subscale measures the belief of the patients regarding control ability of the disease. This study shows the majority (70.8%) of the patients has good level of perception, 28.3% patients have average level of perception and 0.9% patient has poor level of perception. That means, most of the patients believe that, they have many things to do in order to control the disease and they have the capability to control it.

Treatment control subscale of the IPQ-R measures the patients' perception regarding faith on anti-MDR- TB therapy. In this study we found the more than half (50.9%) of the patients have good level of perception, 43.4% patients have average level of perception and only 5.7% patients have poor level of perception. It means more than half of the patients believe that, current treatment will be effective in curing their illness.

Illness coherence subscale measures the belief of the patients about understanding of the disease they are suffering from This study revealed that, 44.4% the patients have good level of perception, 33.8% patients have average level of perception and 21.8% patients have poor level of perception in this subscale . It means, more than 44% patients have a clear picture of their disease.

Timeline-cyclical is a subscale which measures the patients' belief about the nature of the symptoms, whether it is cyclical in nature or not. This study shows (in this subscale) the majority (57.5%) of the patients has poor level

of perception, 30.2% patients have average level of perception and 12.3% patients have good level of perception in this part. It means, most of the patients believe that, the symptoms of MDR-TB is not cyclical in nature.

'Emotional representations' is a subscale that measures the patients' mental condition showing whether they are upset or angry on the disease or not. This study shows that, the majority (69.8%) of the patients have good level of perception, 29.2% patients have average level of perception and 11% patient has poor level of perception. It means majority of the patients are psychologically upset, worried, anxious, depressed, angry or afraid about their MDR-TB.

Summation of all the subscale scores was done to analyze the overall perception about MDR-TB. It revealed the majority (55.7%) of the patients had average level of perception, 30.2% patients have poor level of perception and 14.2% patients have good level of perception.

No relation was found in this study between perception of MDR-TB and sex, educational qualification, occupation, religion, marital status, type of house, type of treatment taken before start of anti-MDR-TB therapy & monthly family income of the patients.

In this study a significant relationship between perception regarding MDR-TB and age of the patients. Perception level is higher among relatively older patients aged 50 years and above; but it falls after this age. Here  $t = 12.36$ , degree of freedom is 6 and p value is 0.05.

### Conclusion:

This study was conducted among MDR-TB patients at National Institute of Diseases of the Chest & Hospital, Mohakhali, Dhaka from January to June 2012. The objective of this study was to assess the level of perception about MDR-TB among the patients suffering from the same. Majority of the patients found to have average level of perception regarding their disease and a small number of patients have good level of perception. Majority of the patients were poor and middle aged. Most of them were either illiterate or had received only primary education. Significant relationship was found between perception of MDR-TB and age of the patients;

perception level was found to be higher among older patients and perception level was found to be lower among younger patients. The most affected domain was emotional representations, then the illness consequence perception. That means, majority of the patients are psychologically upset and believe that MDR-TB is a serious condition with bad outcome. On the other hand, good perception was found in personal control domain and in duration of the disease. That means, majority of the patients believe that, they can influence or control the disease and their disease will not last long. Despite the availability of anti-MDR-TB therapy, there still remains a sizeable poor perception about the disease among the patients. Since much of the current attention on MDR-TB is being given on preventive or curative mechanisms such as drug therapy, the strength and impact of illness perception is rarely considered. In order to achieve a better level of illness perception among the patients of MDR-TB, multi-way approaches like social, mental and educational interventions should be considered.

### Recommendations:

In the light of present study findings, following recommendations are suggested to improve the illness perception of the MDR-TB patients:

1. For the improvement of perception of MDR-TB patients regarding illness identity, effective interventions like health education, information communication and awareness building measures should be implemented.
2. To improve the perception of MDR-TB patients regarding duration, control and consequences of illness, effective measures like health education, mass media communication and motivational interventions should be taken.
3. Effective measures like psychological support, promotion of spiritual health and assurance should be given to the patients to improve their perception regarding emotional representations.
4. To improve the perception regarding treatment control, effective quality of clinical care should be ensured and

measures should be taken to make treatment available & accessible to the MDR-TB patients.

5. To improve the causal belief of the patients, effective interventions like health education, mass media communication and awareness building should be considered.
6. Special attention should be paid towards women, illiterate and poor to improve their overall illness perception.

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## ORIGINAL ARTICLE

# Effects of Pleural Drainage Techniques on Pulmonary Functions after off-pump Coronary Artery Bypass Grafting

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### Abstract:

**Introduction:** Impairment of pulmonary function after CABG is one of the most common complications in early postoperative period. Techniques of pleural drain might have an influence on the discomfort suffered by the patient and on the degree of alterations of the pulmonary function.

**Methods and Materials:** This Prospective Observational Study was conducted in the department of cardiac surgery, National Institute of Cardiovascular Disease & Hospital, Sher-E-Bangla Nagar, Dhaka, Bangladesh from July 2013 to June 2015. Postoperative pulmonary function and other complications were seen up to 3 months after operation. Comparison of the pulmonary function parameters, post-operative pain and other clinical outcomes between patients undergoing pleurotomy with pleural drain placed in subxyphoid and intercostal position after Off-pump coronary artery bypass grafting were done.

**Results:** Total number of patients was sixty divided into 2 groups, Group-A: patients will have a left chest tube inserted through the midline, inferior to the xiphoid process and Group-B: patients will have a left chest tube inserted through the left 5<sup>th</sup> intercostal space along the anterior axillary line. In this study we found that pleural drainage by intercostal approach causes significant deterioration of postoperative pulmonary function variably in terms of FVC, FEV<sub>1</sub> and their ratio in 7<sup>th</sup> postoperative day. Although pain scores assessment did not show significant difference in early postoperative hours, there is significant difference in higher pain perception in group B patients than group A.

**Conclusions:** Pleural drain site selection is a crucial decision in terms of beneficial effects on the respiratory functional and on pain sensation after OPCAB using LIMA graft who sustain pleurotomy.

**Key Words:** Pleural drainage, Off-pump coronary artery bypass grafting.

[Chest Heart Journal 2017; 41(1) : 18-27]

### Introduction:

Impairment of pulmonary function after CABG is one of the most common complications in early

postoperative period. Sternotomy, pain and most importantly pleurotomy with opening of pleural space during harvest of internal mammary artery

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**Submission on:** 10 Aug 2016

**Accepted for Publication:** 25 Jan. 2017;

Available at <http://www.chabjournal.org>

(IMA) may lead to further deterioration of postoperative pulmonary function and complications. Anatomically as we know IMA is closely adherent to chest wall intercostal muscles, ribs and pleura. So, during LIMA (left internal mammary artery) harvest pleurotomy may occur. Iatrogenic injuries to the pleura following harvesting of the LIMA necessitate the placement of chest tubes to prevent hemothorax and/or pneumothorax after surgery. Performance of pleurotomy to harvest IMA graft results greater chest wall and lung parenchyma trauma, greater pain, impaired ability to cough and inhale deeply. In addition IMA dissection may reduce blood supply to ipsilateral intercostal muscle, phrenic nerve injury resulting in diaphragmatic dysfunction and ultimately Atelectasis.<sup>1</sup>

In addition to mediastinal drainage, tube placement for pleural drainage can be performed through a subxiphoid or intercostal approach. Damage to intercostal muscles with irritation of the pleura and intercostal nerves by friction from the chest tubes in intercostal approach can cause post-operative pain and pulmonary morbidities.<sup>2</sup> Consequently, additional analgesic agents, chest physiotherapy for pulmonary sequelae and longer periods of hospitalization may be required.

Previous evidences showed that, pain associated with chest tubes can diminish pulmonary functions because of hypoventilation and atelectasis, particularly in high-risk CABG patients, who have pulmonary disease.<sup>3</sup> Thoracotomy, sternotomy and the placement of pleural chest tubes results in considerable pain in the post-operative period in patients undergoing CABG.<sup>4</sup>

Additionally, contemporary evidence suggest that shifting the site of pleural drain insertion to the subxiphoid position minimizes chest wall trauma and preserve respiratory function in the early post-operative period.<sup>5</sup> Exacerbation of pulmonary dysfunction has been reported in patients receiving a pleural drain inserted through the intercostal space in comparison to patients with mediastinal drain undergoing off-pump CABG.<sup>6</sup>

Among reports of the impact of different routes for tube insertion, one study indicated that the

subxiphoid route leads to significantly less impairment of pulmonary function and less subjective pain than does intercostal insertion.<sup>7</sup>

Pain is more than just a physical process. It is a complex, subjective phenomenon. Pain can impair the hematologic, immune, hormonal, cardiac, and respiratory systems. Pain also can limit mobility, interfere with sleep and rest, and contribute to agitation, Psychosis, aggressive behavior, and delirium. Pain will be assessed by uni-dimensional pain scales that can measure pain intensity and are self-reported by patients are Visual Analogue Scale (VAS) and Verbal Rating Scale (VRS). Among pain measurement tools, the 10-cm Visual Analogue Scale (VAS) and verbal Rating Scale (VRS) is generally considered to be the standard.<sup>8</sup>

Spirometry is one of the earliest and most valuable simplest forms of pulmonary function test performed by a special device called Spirometer. It enables measurement of all lung volumes and of maximal breathing capacity or maximal voluntary ventilation. The test is exceptionally valuable because not only are assessments of individual physiologic variation performed but also the patients stamina, motivation and ability to cooperate with respiratory support personnel can be estimated.

Spirometry can be used to measure the lung volumes. The patient breathes into a mouthpiece while wearing nose clips and usually sits in front of the testing console. Variability is greater in pulmonary function tests than in most other laboratory tests because of inconsistency in patient's effort, and problem with quality control of equipment and testing procedures. Certified technologists are trained to identify what constitute reproducible, satisfactory test results. Modern pulmonary function equipment is extensively automated and computer assisted, so the technologist can see the results of each trial immediately. Computers perform all the necessary calculations and prepare a report.<sup>9</sup>

Pulmonary function test is routinely done as a preoperative workup. Reduction of forced vital capacity (FVC) and forced expiratory volume in 1 second ( $FEV_1$ ) are reported to be 40–50% on the first to third postoperative.<sup>10</sup> Postoperative atelectasis are common in all patients undergoing open-heart surgery and the reduced lung volumes contribute

to impaired gas exchange.<sup>11</sup> An inverse correlation between atelectatic area and arterial oxygenation (PaO<sub>2</sub>) is reported on the first and second postoperative days after open-heart surgery.<sup>12</sup>

Surgical centers need to pay attention to pain management and postoperative pulmonary morbidities because there appears to be a direct relationship between these and cost of medical care, time spent in an intensive care unit, and length of hospital stay.

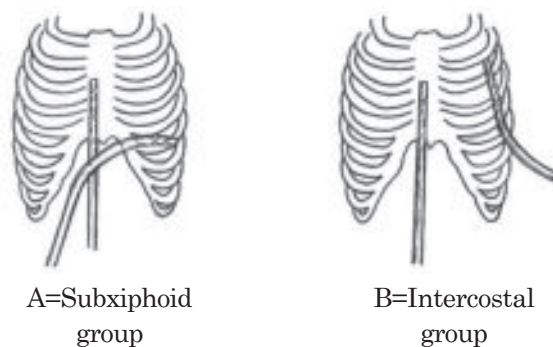
In our surgical practice, we typically insert chest tubes into left hemithorax through the intercostal approach in addition to mediastinal drain for better drainage of blood and air.

### Materials and Methods:

This Prospective Observational Study was conducted in the department of cardiac surgery National Institute of Cardiovascular Disease (NICVD), Sher-E-Bangla Nagar, Dhaka, Bangladesh from July 2013 to June 2015. Samples were taken purposively. Total number of patients was sixty divided into 2 groups, Group-A: patients will have a left chest tube inserted through the midline, inferior to the xiphoid process (the subxiphoid approach) and Group-B: patients will have a left chest tube inserted through the left 5<sup>th</sup> intercostal space along the anterior axillary line (the intercostal approach). The study was carried out among the patients who are undergoing OPCAB surgery using LIMA graft with pleurotomy in NICVD and Exclusion criteria were Left ventricular ejection fraction < 40%, Patient undergoing emergency surgery, Renal insufficiency, Taking NSAIDs or tranquilizers on chronic basis, Previous cardiac surgery, Conversion to cardiopulmonary bypass, Bilateral opening of pleural cavities and Postoperative neurological dysfunction and hemodynamic instability. Detailed history of each patient under study was recorded, Important and relevant findings on thorough physical examinations and investigations were collected.

All patients will undergo median sternotomy and harvesting of LIMA. The LIMA will be harvested using diathermy and a chest retractor on one side of the sternum after wide opening of the left pleura. Standard OPCAB will be performed. In each patient, 2 soft 32F chest tubes will be used after surgery to drain blood and air from the chest

cavity. In group A patients, chest tubes were inserted through the subxiphoid area. A tube will be angled to place in the left hemithorax, and the tip of this tube placed in the left costophrenic angle above the diaphragm. Another tube will be placed in the anterior mediastinum. In group B patients, a chest tube will be inserted in the left hemithorax through the left 5<sup>th</sup> intercostal space along the anterior axillary line and the tip of this tube will be directed toward the apex of the left lung. Another tube will be passed through the subxiphoid area into anterior mediastinum. All tubes will be connected to an underwater drainage system. Chest radiographs confirmed the placement and position of the tubes. (Figure : 1)



**Fig.-1:** Groups according to chest drain site

Postoperatively, all patient will be routinely given 1-2mg/Kg of ketorolac intravenously every 8 hourly during the first 48 hours after postoperative extubation. The uni-dimensional pain scales that can measure pain intensity and are self-reported by patient. They are Verbal Rating Scale (VRS) and Visual Analogue Scale (VAS). Visual Analogue Scale (VAS) involves asking the patients to rate their pain from 0 – 10 (11 points) with the understanding that 0 represents one end of pain intensity continuum (no pain) and 10 represents the other extreme of pain intensity (Unbearable pain). The strength of VAS is its simplicity and therefore can be used with a great variety of patients. The verbal rating scale (VRS) consists of a list of adjectives describing different levels of pain intensity that reflect from 'no pain' to 'severe pain'. Patients will be asked to read over the list of adjectives and select the word or phrase that best describes their level of pain on the scale. It is a 4 point scale of no pain = 0, mild = 1, moderate = 2 or severe = 3. If a patient's Visual Analogue Scale (VAS) pain score from 5 through



8 or the Verbal rating Scale(VRS) pain score 3, 1 mg/kg of tramadol will be delivered intravenously.

If pain persist, the VAS score above 8, or the VRS score 4, 1 mg/kg of pethidine will be injected intramuscularly. All pain scores and consumption of analgesics will be recorded. The effects of analgesia will be evaluated in accordance with VAS and VRS scores at 1, 3, 6, 12, 18, 24, and 48 hours after postoperative extubation, after which time the chest tubes will be removed.

Postoperative pulmonary morbidities will be recorded, which are atelectasis, pleura effusion, amount of drainage from the chest tubes, breaths per minute and the results of blood gas analysis, including PaO<sub>2</sub>, PaCO<sub>2</sub>, and oxygen saturation levels.

To evaluate intrapleural fluid retention, atelectasis, and diaphragmatic elevation, chest radiography will be performed on each of the 2 days after surgery. Chest radiography will also used to detect residual pleural fluid on postoperative day 4, again upon each patient's discharge from the hospital, and finally at the 1-month follow-up examination. Spirometric evaluation will be done at 7<sup>th</sup> post-operative day and it will be matched with pre-operative values.

Data were collected by clinical examination, laboratory investigations, preoperative, peroperative and postoperative findings using the research instrument. Statistical analysis of the results was done by SPSS.

### Results:

Among 60 patients 55 patients were male and 5 patients were female. The mean age of group A patients was 49.0 ±6.9 years and that of group B patients was 48.6±6.3 years. The mean age difference was not statistically significant (p>0.05) in unpaired t-test. percentages of male and female patients were 90.0% and 10.0% in group A and 93.3% and 6.7% in group B respectively, with no significant difference between the groups in respect to sex (p = 0.229) mean weight in Group-A mean BMI was 26.72±6.78 kg and that of Group-II was 28.90±8.76 preoperative NYHA functional Class I, II, III and IV occupied 6.7%, 36.6%, 50.0% and 6.7% respectively in group A. In-group B preoperative NYHA Functional Class I, II, III and IV occupied 3.3%, 50.0%, 43.4% and 3.3%

respectively and the difference was not statistically significant (p>0.05)between group A and group B in chi square test.(Table I)

Among all groups of OPCAB surgery patients the mean number of grafts was 2.2+1.3 and 2.0+1.2 in group A and group B respectively. Total operating time in group A was 275+43.21 minutes and in group B it was 268 + 39.45 minutes. The difference of all preoperative variables was statistically non-significant(p>0.05) between group A and group B in unpaired 't' test.

Among 60 patients during preoperative period the mean value of PaO<sub>2</sub>, PaCO<sub>2</sub> and SPO<sub>2</sub> were 94±5.4 mmHg, 33±6 mmHg and 96.7±3.7 % in group A respectively. In-group B the mean value of PaO<sub>2</sub>, PaCO<sub>2</sub> and SPO<sub>2</sub> were 95±3.2 mmHg, 32±4 mmHg and 97±3.6 % respectively.

At 4 hour before extubation the mean value of PaO<sub>2</sub>, PaCO<sub>2</sub>, SPO<sub>2</sub> and FiO<sub>2</sub> were 156.4±40.4 mmHg, 35.4±3.8 mmHg, 99.1±0.7% and 48.2±4.5% in group A respectively. In-group B the mean value of PaO<sub>2</sub>, PaCO<sub>2</sub>, SPO<sub>2</sub> and FiO<sub>2</sub> were 172.0±27.8 mmHg, 32.0±4.1 mmHg, 99.7±0.3% and 46.8±4.1% respectively.

At 1 hour before extubation the mean value of PaO<sub>2</sub>, PaCO<sub>2</sub>, SPO<sub>2</sub> and FiO<sub>2</sub> were 130±25.4 mmHg, 34.8±5.6 mmHg, 99.2±0.7% and 45.1±4.5% in group A respectively. In-group B the mean value of PaO<sub>2</sub>, PaCO<sub>2</sub>, SPO<sub>2</sub> and FiO<sub>2</sub> were 140±42.2 mmHg, 32.9±3.9 mmHg, 98.9±0.2% and 42.0±1.6% respectively.

At 1 hour after extubation the mean value of PaO<sub>2</sub>, PaCO<sub>2</sub>, SPO<sub>2</sub> and FiO<sub>2</sub> were 100.7±12.6 mmHg, 35.6±5.7 mmHg, 98.5±1.2% and 35.3±4.8% in group A respectively. In-group B the mean value of PaO<sub>2</sub>, PaCO<sub>2</sub>, SPO<sub>2</sub> and FiO<sub>2</sub> were 115.6±21.8 mmHg, 33.8±5.1 mmHg, 99.0±0.4% and 33.6±5.5% respectively.

At 4 hour after extubation the mean value of PaO<sub>2</sub>, PaCO<sub>2</sub>, SPO<sub>2</sub> and FiO<sub>2</sub> were 95.7±8.5 mmHg, 34.4±7.7 mmHg, 98.6±1.1% and 31.6±4.2% in group A respectively. In-group B the mean value of PaO<sub>2</sub>, PaCO<sub>2</sub>, SPO<sub>2</sub> and FiO<sub>2</sub> were 105.9±10.5 mmHg, 32.7±5.8 mmHg, 98.6±0.7% and 28.4±3.5% respectively.

At 7th days after operation the mean value of PaO<sub>2</sub>, PaCO<sub>2</sub> and SPO<sub>2</sub> were 87.6±2.4 mmHg, 34.6±5.6 mmHg and 98.2±0.7 % in group A respectively. In-group B the mean value of PaO<sub>2</sub>, PaCO<sub>2</sub> and SPO<sub>2</sub> were 88.8±2.2 mmHg, 33.9±3.9 mmHg and 96.9±0.2% respectively.

The mean value of PaO<sub>2</sub>, PaCO<sub>2</sub>, FiO<sub>2</sub>, SPO<sub>2</sub> was not statistically significant (p<0.05) between two groups preoperatively, at 4 and 1 hour before and after extubation and at 7th POD.(Table II)

Among 60 patients preoperative mean value of FVC was 3.45±1.01L in-group A and 3.29±1.00L in-group B. The mean value of %FVC was 98.67±32.34% in group A and 99.52±26.92% in group B. The mean value of FEV<sub>1</sub> was 2.69±0.35L in-group A and 2.84±0.93L in group B. The mean value of % FEV<sub>1</sub> was 80.00±16.46% in group A and 78.36±32.31% in group B. The mean value of FEV<sub>1</sub>/FVC was 96.43±14.87 in group A and 94.91±12.78 in group B.

In 7th POD mean value of FVC was 3.04±0.53L in-group A and 2.57±0.66L in group B. The mean value of %FVC was 78.47±12.35% in group A and 73.99±15.30% in group B. The mean value of FEV<sub>1</sub> was 2.47±0.22L in-group A and 1.77±0.60L in group B. The mean value of % FEV<sub>1</sub> was 79.85±7.7% in group A and 56.81±17.76% in group B. The mean value of FEV<sub>1</sub>/FVC was 82.08±11.72 in group A and 78.02±12.17 in group B.

Analysis revealed no statistically significant (p<0.05) preoperative spirometric parameter difference was found between two groups but

during 7th POD FEV<sub>1</sub>, %FEV<sub>1</sub> and FEV<sub>1</sub>/FVC were statistically significant (p<0.05).(Table III)

Among 60 patients mean value of mechanical ventilation time was 7.5±3.5 hour in group A and 10.3±7.1 hour in group B. The prolonged ventilation (>24 hour) were 1(3.3%) and 3(10%) in group A and group B respectively. The mean value of ICU stay was 2.3±0.6 days in group A and 5.6±8.1 days in group B. The mean value of blood loss was 471.2±82.1 ml in group A and 634.8±96.1 ml in group B. The reintubation was 3(10.0%) and 5(16.7%) in group A and group B respectively. The respiratory failure (Death) was 1(3.3%) and 2(6.7%) in group A and group B respectively. All postoperative parameters were statistically significant (p<0.05) between two groups except prolonged ventilation, reintubation and respiratory failure.(Table IV)

The table V depicted complications as revealed by the chest X-ray was found 3(10.0%) atelectasis, 2(6.7%) pleural effusion unilateral, 1(3.3%) pneumothorax and no empyema in group A. In group B 2(6.7%) atelectasis, 4(13.3%) pleural effusion unilateral, 2(6.7%) pneumothorax and 1(3.3%) empyema. No statistical significant (p>0.05) was found between two groups. (Table V)

The table VI showed two methods of pain scores e.g. visual analogue scale and verbal rating scale in 1,3,6,12,18,24 and 48 hours after extubation. In both scale pain scores were insignificant in 1<sup>st</sup> and 3<sup>rd</sup> hour between group A and group B. Difference in pain scores after 6,12,18,24 and 48 hours were significant between the groups. (Table VI)

**Table-I**  
*NYHA class of the study patients*

NYHA Class	Group-A (n=30)		Group-B (n=30)		p-value
	n	%	n	%	
Class I	2	6.7	1	3.3	0.553 NS
Class II	11	36.6	15	50.0	0.602 NS
Class III	15	50.0	13	43.4	0.592 NS
Class IV	2	6.7	1	3.3	0.717 NS

Group-I: Subxiphoid ,

Group-II= Intercostal

Insignificant (p>0.05) with chi-square test.

**Table-II**  
*Comparison of gas analysis data between Group-A and Group-B*

	Group A	Group B	P value
Preoperative period			
PaO <sub>2</sub> (mmHg)	95±3.2	94±5.4	0.713
PaCO <sub>2</sub> (mmHg)	32±4	33±6	0.512
SPO <sub>2</sub> (%)	97±3.6	96.7±3.7	0.393
At 4 hour before extubation			
PaO <sub>2</sub> (mmHg)	172±27.8	156±40.4	0.088
PaCO <sub>2</sub> (mmHg)	32.0±4.1	35.4±3.8	0.643
SPO <sub>2</sub> (%)	99.7±0.3	99.1±0.7	0.099
FiO <sub>2</sub> (%)	46.8±4.1	48.2±4.5	0.215
At 1 hour before extubation			
PaO <sub>2</sub> (mmHg)	140±42.2	130±25.4	0.713
PaCO <sub>2</sub> (mmHg)	32.9±3.9	34.8±5.6	0.512
SPO <sub>2</sub> (%)	98.9±0.2	99.2±0.7	0.393
FiO <sub>2</sub> (%)	42.0±1.6	45.1±4.5	0.068
At 1 hour after extubation			
PaO <sub>2</sub> (mmHg)	115.6±21.8	100.7±12.6	0.884
PaCO <sub>2</sub> (mmHg)	33.8±5.1	35.6±5.7	0.144
SPO <sub>2</sub> (%)	99.0±1.4	98.5±0.9	0.459
FiO <sub>2</sub> (%)	33.6±5.5	35.3±4.8	0.742
At 4 hour after extubation			
PaO <sub>2</sub> (mmHg)	105.9±10.5	95.7±8.5	0.208
PaCO <sub>2</sub> (mmHg)	32.7±5.8	34.4±7.7	0.340
SPO <sub>2</sub> (%)	98.9±0.7	98.3±1.1	0.957
FiO <sub>2</sub> (%)	28.4±3.5	31.6±4.2	0.117
7th day after operation			
PaO <sub>2</sub> (mmHg)	88.8±2.2	87.6±2.4	0.713
PaCO <sub>2</sub> (mmHg)	33.9±3.9	34.8±5.6	0.512
SPO <sub>2</sub> (%)	98.9±0.2	97.2±0.7	0.393

Group A: Subxiphoid approach

Group B: Intercostal approach

p value reached from unpaired student's t test(p<0.05)

p value reached from unpaired student's t test(p>0.05)

**Table-III**  
*Comparison of preoperative and postoperative spirometric parameters:*

	Preoperative			7 <sup>th</sup> POD		
	Group A	Group B	P value	Group A	Group B	P value
FVC	3.45±1.01	3.29±1.00	0.83NS	3.04±0.53	2.57±0.66	0.47NS
%FVC	98.67±32.34	99.52±26.92	0.33NS	78.47±12.35	73.99±15.3	0.43NS
FEV <sub>1</sub>	2.69±0.35	2.84±0.93	0.90NS	2.47±0.22	1.77±0.60	0.045
%FEV <sub>1</sub>	80.00±16.46	78.36±32.31	0.92NS	79.85±7.7	56.81±17.76	0.035
FEV <sub>1</sub> / FVC	96.43±14.87	94.91±12.78	0.97NS	82.08±11.72	78.02±12.17	0.045

Group A: Subxiphoid

Group B: Intercostal

Insignificant (p > 0.05) with paired t-test

Significant (p < 0.05) with paired t-test

**Table-IV**  
*Postoperative findings*

Postoperative findings	Group A (n=30)	Group B (n=30)	P value
Mechanical ventilation time(hour)	9.5±3.9	12.3±7.1	0.041
Prolonged ventilation (>24 hour)	1(3.3%)	3(10%)	0.305NS
ICU stay (day)	2.3±0.6	5.6±8.1	0.035
Amount of blood loss (ml)	471.2±82.1	634.8±96.1	0.029

Group A: Subxiphoid approach

Group B: Intercostal approach

Significant ( $p < 0.05$ ) with unpaired t-test

Insignificant ( $p > 0.05$ ) with unpaired t-test

Postoperative findings	Group A (n=30)	Group B (n=30)	P value
Reintubation	3(10.0%)	5(16.7%)	0.353NS
Respiratory failure (Death)	1(3.3%)	2(6.7%)	0.553NS

Group A: Subxiphoid approach

Group B: Intercostal approach

Insignificant p value ( $p > 0.05$ ) reached from chi-square test

**Table-V**  
*Complication as revealed by chest X-ray*

Chest X-ray	Group-A (n=30)		Group-B (n=30)		Test statistic P value
	n	%	n	%	
Atelectasis	3	(10.0%)	2	(6.7%)	0.218 NS
Pleural effusion	2	(6.7%)	4	(13.3%)	0.72 NS
Pneumothorax	1	(3.3%)	2	(6.7%)	0.336 NS
Empyema	0	(0%)	1	(3.3%)	1.016 NS

Group A: Subxiphoid approach

Group B: Intercostal approach

Insignificant p value ( $p > 0.05$ ) reached from chi-square test

**Table-VI**  
*Pain scores*

Afterextubation	VAS			VRS		
	Group A	Group B	P value	Group A	Group B	P value
1 hour	6.00±1.7	7.16±1.92	1.43NS	2.66±0.84	2.83±0.66	0.82NS
3 hour	5.67±1.45	6.98±1.89	1.33NS	2.47±0.75	2.99±0.58	0.79NS
6 hour	4.49±0.35	7.84±0.93	4.43	4.36±0.22	2.62±0.60	3.16
12 hour	5.14±0.46	8.36±0.61	4.92	3.98±0.32	2.54±0.67	4.02
18 hour	4.84±0.42	7.36±0.57	3.97	4.14±0.29	2.67±0.59	3.45
24 hour	4.57±0.46	7.36±0.69	4.52	4.09±0.24	3.12±0.71	3.29
48 hour	5.34±0.47	7.56±0.72	4.67	4.28±0.30	2.97±0.68	3.67

Group A: Subxiphoid approach

Group B: Intercostal approach

Insignificant p value ( $p > 0.05$ ) reached from unpaired student's t-test.

## Discussion

The insertion of an intercostal pleural drain causes additional injury to the thorax, as it becomes necessary to perforate intercostal muscles and the parietal pleura, interfering in the respiratory movements. Consequently, the location of the pleural drain might have an influence of the discomfort suffered by the patient and on the degree of alterations of the pulmonary function.<sup>5</sup>

The mean age was 57.7±11.6 years in subxiphoid approach group A and 55.7±10.4 years in intercostal approach group B in the study of Mustafa and his colleagues Male /female ratio in the two groups was 10/10 and 12/8.<sup>13</sup> A study by Vieira and his colleagues had a mean age of 56.4±1.7 years in subxiphoid group and 59.2±8.4 intercostal group and male /female ratio was 12/4 and 8/7. In this study the patients in the both groups have been divided into age ranges of 30-40 years, 41-50 years, 51-60 years, 61-70 years. All the age groups were almost proportionately distributed in both the study groups. The mean ages of subxiphoid approach group A and intercostal approach group B of 60 patients were 49.7 ±6.9 years and 48.6±6.3 years respectively. Male/female ratio was 27/3 and 28/2. The mean age and sex difference was not significant between two groups.<sup>14</sup>

In a study by Hagland his colleagues most of the patient of CABG was in NYHA class III and Class II respectively. In this study, most of the patients in both groups were in NYHA Class II and class III percentage of which were 36.6% vs. 50 % in NYHA class II and 50% vs. 43.4% in group-A and group-B respectively.<sup>7</sup>

Regarding arterial blood gas analysis (ABG) in this study, at NICVD showed that the chest drain placed at intercostal location negatively influenced blood arterial gas concentrations, resulting in a lower PaO<sub>2</sub> and higher PaCO<sub>2</sub> and FiO<sub>2</sub> during after extubation, which returned to similar levels only during 6th Postoperative day with subxiphoid group. However, the arterial blood gas results were within the acceptable postoperative values in all patients in both groups. The analysis of the arterial blood gases revealed no significant difference in between patients with subxiphoid chest drain and intercostal drain in a study by Guiziliniand his colleagues.<sup>6</sup>

The most vital lung function test by spirometry like FEV<sub>1</sub>, FVC and their ratio was assessed preoperatively, at 7th POD of OPCABG in both groups of patients. In the study by Vieira and his colleagues the mean FEV<sub>1</sub> (%) declined from its preoperative value of 79.4 ±1.8 to 76.0±1.6 at 7th POD but improved to 88.0±1.9 in intercostal group. On the other hand, in subxiphoid group FEV<sub>1</sub> declined from its preoperative value 83.2±1.6 to 81.7 ±1.5 at 6<sup>th</sup> POD. The decline of FEV<sub>1</sub> at 6th POD were significantly (p=0.020) differ between two groups although there were no difference preoperatively between two groups.<sup>14</sup> In the study by Guiziliniand his colleagues also showed that the mean FVC (%) in subxiphoid group declined from its preoperative value of 100.4±2.1 to 87.4±3.0 at 6th POD and in intercostal group mean FVC (%) declined from its preoperative values of 98.1±1.7 to 74.6±2.5 at 6th POD. The decline of FVC was significantly differing in both groups at 6th postoperative day. The ratio between FEV<sub>1</sub>/FVC declined from its preoperative value of 0.958±0.020 to 0.771±0.021 at 6th postoperative day in intercostal group and in subxiphoid group the ratio declines from its preoperative value of 0.972± 0.027 to 0.832± 0.020 at 6th post operative day. There were no significant difference between two groups in terms of ratio both pre operatively, although the two groups significantly differ (p=0.003) at 6th postoperative day.<sup>6</sup>

In this study, here at NICVD, lung function test was done by spirometry preoperatively, at 6th postoperative day after operation in all patients of both groups. The mean FEV<sub>1</sub> (in litre) in group-B declined from its preoperative value of 2.84 ± 0.93 L (78.36± 32.31%) to 1.77 ± 0.60 L (56.81± 17.76%). In group- A the mean FEV<sub>1</sub> (in Litre) declined from its preoperative value of 2.69±0.35L (80.00 ±16.46%) to 2.47± 0.22 L (79.85± 7.7%) at 7th post operative day. There were no difference in both groups both preoperatively but there is significant difference (p=0.04) of FEV<sub>1</sub> values in both groups at 7<sup>th</sup> postoperative day. The mean FVC (in Litre) in group-B declined from its preoperative values of 3.29±1.0 L (99.52±26.92%) to 2.57± 0.66 L (73.99±15.3 %) at 7th postoperative day. In group- A the mean FVC (in Litre) declined from its preoperative values of 3.45±1.01L (98.67± 32.34%) to 3.04±0.53 L (78.47±12.35%). There were no significant

difference of FVC between two groups preoperatively and at 7<sup>th</sup> postoperative day. The mean ratio of FEV1/FVC (%) declined from its preoperative values of  $94.91 \pm 12.72$ ,  $96.43 \pm 14.87$  to  $78.02 \pm 12.17$ ,  $82.08 \pm 11.72$  at 7<sup>th</sup> postoperative day in group-B and group-A respectively. There were no significant difference of FEV1/FVC ratio between two groups preoperative yet the ratio significantly differ ( $p=0.045$ ) at 7<sup>th</sup> postoperative day in both groups of patients (Table VII).

Post operative findings at ICU in the study by Hagland his colleagues showed that Mechanical ventilation time in hours and prolonged ventilation (>24 hr) in hours in intercostal group and subxiphoid group patients were  $6.2 \pm 2.9$  vs.  $5.4 \pm 1.2$  hr and 16(9%) patient vs. 1(1.25%) patient respectively. Reintubation incidence was 6(7.5%) vs. 2(2.5%) in group-A and group-B respectively. Mortality due to respiratory failure was 7 (3.7%) vs. 2 (2.4%) in intercostal group and subxiphoid group patients respectively.<sup>7</sup> In a study by Mustafa and his colleagues revealed postoperative blood loss at ICU in first 12 hours were significantly in intercostal group than in subxiphoid group patients ( $608 \pm 58$  ml vs.  $470 \pm 48$  ml  $p=0.027$ ) and mean ICU stay were ranges from 3.8-6.1 days with  $\pm 0.16$  days. In this study the postoperative event at ICU showed that mechanical ventilation time in hours increased significantly in group-B (intercostal group) than group-A (subxiphoid group), which were  $12.3 \pm 7.1$  hr vs.  $9.5 \pm 3.9$  hrs ( $p=0.04$ ). Prolong ventilation (>24 hr) were also higher in group- B than group-A (3 patients vs. 1 patients) but not significantly between the groups. Mean ICU stay ( $5.6 \pm 3.1$  vs  $2.3 \pm 0.6$  days  $p=0.0335$ ) and blood loss in first 12 hours ( $634.8 \pm 96.1$  vs.  $471.2 \pm 82.1$ ml  $p=0.029$ ) were significantly higher in group-B than in group-A. The incidence of reintubation was higher in group-B than in group-A (16.7% vs. 10%) but no significant difference were found between two groups. Mortality due to respiratory failure was also higher in group-B than group-A (6.7% vs. 3.3%) although not significantly between two groups (Table IV).<sup>13</sup>

Post operative complications as revealed by postoperative chest X ray in the study by Guizilini and his colleagues showed that atelectasis, unilateral pleural effusion and pneumothorax were higher in intercostal group than subxiphoid group

as shown by 20.7 % vs. 7.5%, 29 % vs. 13.4% and 13.4% vs. 6% respectively. In another study by Mustafa and his colleagues revealed that atelectasis and pleural effusions were significantly higher in intercostal group than in subxiphoid group patients (42.1% vs. 20%  $p=0.015$  and 52.6% vs. 23.6 %  $p=0.002$ ) at 7<sup>th</sup> post operative day. In this study, chest x ray were done preoperatively, at 7<sup>th</sup> postoperative day in addition to routine chest x ray immediately after operation on arrival to ICU to detect pulmonary and other complications. In early post operative day especially in patients with prolonged mechanical ventilation we saw that atelectasis were more in group-A than in group-B (10% vs. 6.7%) some of these patient along with others subsequently developed pneumothorax and pleural effusion on post operative days which showed more in favor of group-B than group-A pleural effusion (13.3% vs. 6.7 %), pneumothorax (6.7% vs. 3.3%) and empyema (3.3% vs.0%). However though these complications were more in group-B than group-A but no significant difference were found between two groups neither in early postoperative period (7<sup>th</sup> POD).<sup>6</sup>

Regarding postoperative pain one previous study done by Guizilini and his colleagues revealed that the intensity of pain in the intercostal group was greater than that of subxiphoid group. The distributions of the pain score were distinct, with a mean of  $7.2 \pm 1.52$  for the intercostal group and  $5.00 \pm 1.58$  for the subxiphoid group ( $p$  value 0.002). Another study by Andreia and his colleagues showed that statistical significant higher pain sensation in intercostal group with a mean of  $7.15 \pm 1.06$  in contrast to  $4.81 \pm 1.80$  in subxiphoid group ( $p$  value <0.0001). In this study difference in pain scores after 6,12,18,24 and 48 hours were significant between the groups ( $p<0.05$ ).<sup>6</sup>

### Conclusion:

It may be concluded that the pleural drain site selection is a crucial decision in terms of beneficial effects on the respiratory functional and on pain sensation after OPCAB using LIMA graft who sustain pleurotomy. A meticulous and more judicious decision regarding pleural drain site selection reduces the postoperative morbidity regarding pain management and pulmonary functional status, and as a consequence, reduces the hospital costs.

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## ORIGINAL ARTICLE

# Foam Sclerotherapy in the Treatment of Venous Malformation- A Single Centre Experience

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### Abstract:

**Introduction:** Venous malformations are one of the commonest anomalies of the vascular tree and their management has always remained a major challenge. Surgery and other treatment modalities are not always satisfactory and have a higher morbidity, recurrence and complication rate. The author prospectively analyzed 50 patients of venous malformations who underwent foam sclerotherapy with sodium tetradecyl sulfate solely or as an adjunct to surgery. The purpose of the study was to evaluate the efficacy and safety of sodium tetradecyl sulfate sclerotherapy in the treatment of venous malformations.

**Result:** Sclerotherapy provided significant improvement or resolution of symptoms in good number of the patients.

**Conclusion:** Percutaneous sodium tetradecyl sulfate when used either alone or as adjunct to surgery is a safe, effective and inexpensive agent in the treatment of venous malformations.

**Keywords:** Sclerotherapy, sodium tetradecyl sulfate, venous malformations, foam sclerotherapy.

[Chest Heart Journal 2017; 41(1) : 28-32]

### Introduction:

Venous malformations are part of the spectrum of vascular malformations in which dominant structures are histologically mature venous channels.<sup>1</sup> Venous malformations are difficult to treat. Various treatment modalities have been described for their management.<sup>2-5</sup> Surgical excision is difficult and often complete removal is not possible.

Sclerotherapy is currently an established modality for the management of venous malformation. Sclerotherapy is direct injection of a sclerosing solution into the epicenter of the venous malformation. When sclerosing solution is

converted into foam by mixing air with it before injection, this is known as foam sclerotherapy. The resultant endovascular obliteration of low flow venous anomalies results in satisfactory outcome.

### Materials and Methods:

The study was conducted in the department of vascular surgery, National Institute of Cardiovascular Diseases (NICVD), Dhaka from January, 2014 to December, 2016 at weekly 'AVM clinic'. Percutaneous foam Sclerotherapy was performed with sodium tetradecyl sulfate in 50 patients of venous malformations who were aged between 5-40 years.

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**Submission on:** 12 Sept. 2016,

**Accepted for Publication:** 25 Jan. 2017;

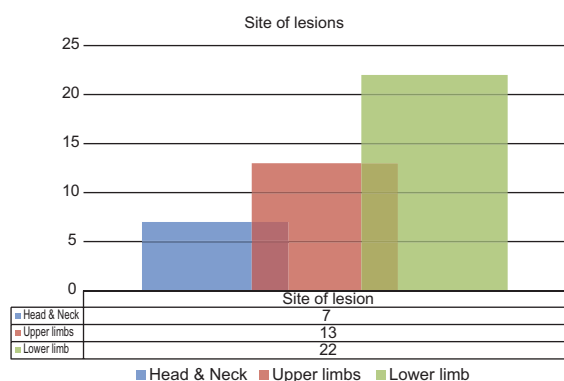
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## Demography

Age	Male	female
1-10	2	1
11-20	2	3
21-30	3	12
31-40	10	17
N= 50	17	33

Only significantly sized cutaneous and mucosal focal venous malformations (minimum diameter > 4 cm) were included in the study. Extensive venous malformations and those necessitating anesthesia were excluded from the study. Contrast magnetic resonance imaging (MRI) was done for evaluation only in selected cases. Appropriate informed consent was obtained. Sclerotherapy with sodium tetradecyl sulfate was a sole therapy in thirty-five patients and was used in combination with surgical excision in fifteen patients. With a single exception, all venous malformations were preset at birth. The male to female ratio was 1:2. Three patients had a first degree and another three had second degree relatives with venous malformations. The head and neck was involved in seven(7) patients, trunk in eight(8), upper limbs in thirteen(13) and lower limbs in twenty two(22) patients. The lip was found to be involved in two out of seven cases of head and neck presentation. Mean follow-up was one year. Each patient underwent one to five Sclerotherapy sessions, followed by surgery in fifteen cases.



## Technique of injection

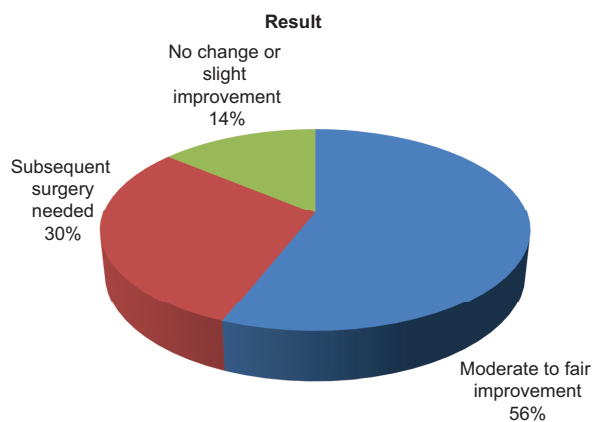
2ml of injection containing 60mg STS was mixed with 2ml of distilled water resulting in 1.5% STS solution. 4ml air was mixed with the solution by

'Tessari method'.

After cleansing of the area, areas to be injected were marked 1 cm apart. 2 ml of sodium tetradecyl sulphate foam was given intralesionally with hypodermic needle, directly into skin/mucosa, at multiple sites and contained within the lesion using manual compression for 15 to 20 minutes. The total dose was not exceeded by more than 1ml/kg/session and care was taken to prevent extravasation of sclerosant. Blood loss was minimal. Only simple analgesics were given after sclerotherapy. Elasticated crepe bandage was applied around the site of injection (in case of limb) and kept in situ for 72 hours. The injections were repeated after an interval of three weeks depending upon the merit of individual case, up to the maximum of five sessions.

## Results:

Sclerotherapy provided significant improvement or resolution of symptoms in good number of the patients. Out of the 50 patients, 28 patients showed moderate to fair improvement, with a very significant degree of satisfaction. In fifteen patients, it facilitated subsequent surgery, which was rendered by it, a relatively easier procedure. Seven patients were dissatisfied for having no change or only slight improvement.



## Complications and sequelae

All patients experienced pain and swelling to a variable degree which lasted typically not more than a week. A mild degree of inflammatory reaction of the overlying skin / mucosa occurred in majority of the cases. In none of the patients was any toxic-response noted at the time of injection. After injection, bleeding was noted in

all the patients, which was easily controlled with pressure for five to seven minutes. In three patients, skin ulceration was noted which healed with local wound care. In one patient, full thickness necrosis of the overlying skin occurred which later required debridement, dressings and skin grafting.

### Discussion:

Vascular malformations are true in-born errors in the embryologic development of the vascular tree and by definition are all present at birth though not all clinically apparent<sup>6</sup>. The venous malformations are the commonest of all the vascular anomalies and have a propensity for the head and neck<sup>1</sup>. They can cause pain, bleeding, restriction of movement, pressure on adjacent structures, consumptive coagulopathy and aesthetic concern. They may be discrete or extensive. The overall incidence of venous malformations is reported to be 1-4% of the population and there is no predilection for either sex. They are usually singular, isolated presentations but may occur in multiple areas. They may manifest clinically in infancy, childhood, adulthood or they may remain asymptomatic throughout life. They grow commensurately with the developing child and unlike hemangiomas do not regress. Venous malformations may occur in pure form or they may be combined capillary-venous or lymphaticovenous malformations. The microscopic examination reveals dilated proliferation in vascular channels lined by normal flattened endothelial with normal mast cells count. These endothelial cells characteristically have normal rate of turn-over. MRI is the most informative investigation for venous malformations and gives off a decreased signal intensity on the T1-weighted image as compared with fat and a hyperintense signal intensity on the T2-weighted image<sup>7</sup>. MRI can distinguish low-flow venous malformations from high-flow arteriovenous malformations and fistulas along with delineation of the neurovascular structures, adjacent or involved with the malformations.

Management of venous malformations has always remained a major challenge because treatment carries a significant risk of morbidity and the recurrence. Surgical resection, though definitive

treatment, is often not feasible except for smaller lesions because of deeper involvement of neurovascular structures particularly in the head and neck and extremity malformations. Incompletely excised lesions have a strong tendency to recur.

Laser treatment of venous malformations have also been attempted with varying success rate<sup>8</sup>. Laser photocoagulation with argon, Nd-Yag or combination lasers have been found to be somehow effective for tiny superficial venous or capillary-venous lesions but not for significantly sized lesions. Recurrence is common and often repeated treatments are necessary. Hence they may be useful in select group of patients<sup>9,10</sup>.

Sclerotherapy alone or in combination with surgical excision is now the accepted treatment modality in symptomatic venous malformations. Localized areas can be treated without an incision and diffuse, extensive lesions may be symptomatically palliated. Conservative management with numerous sclerosing agents (boiling water, alcohol, sodium morrhuate, quinine, urethan, silver nitrate, iron, zinc chloride, liquid vegetable protein)<sup>4,5,11,12</sup> have been used since the 18th century for the treatment of a wide variety of vascular anomalies.

Sclerosing agents basically are irritants that injure the endothelial surfaces, ultimately resulting in obliteration of the space between these surface.<sup>13</sup>

Sclerosing agents have been classified into three groups based on the mechanism of action causing the injury to the endothelium.<sup>14</sup>

A) Detergents: Polidocanol, sodium tetradecyl sulfate, sodium morrhuate and ethanolamine oleate. The detergents cause injury by altering the surface tension surrounding endothelial cells.

B) Osmotic agents: Hypertonic saline, hypertonic saline / dextrose.

They act through endothelial damage through dehydration.

C) Chemical irritants: Chromated glycerin, polyiodinated iodide.

The chemical irritants include the corrosives, which act by a cauterizing action and those which injure cells by a heavy metal effect.

Direct injection sclerotherapy is a valuable treatment modality for venous malformations with promising results. Percutaneous ethanol has been found to be effective in various studies.<sup>15,16</sup> However ethanol embolization is a significant risk. Absolute alcohol is the most effective sclerosant but should not be used near important structures like vessels and nerves, where 3% sodium tetradecylsulfate is preferred.<sup>[17]</sup> Ethibloc has also been utilized for sclerotherapy but the drawback of lack of commercial availability and necessity for GA precludes its use.<sup>[18]</sup> The sodium tetradecyl sulfate has been used extensively for sclerotherapy of varicose veins since it was first described by Reiner in 1946.<sup>[19]</sup> Many of the previous studies have noted good results achieved in vascular malformations with the use of this substance.<sup>1,20,21</sup> However Sclerotherapy of major venous malformations is dangerous and must be performed by a skilled and experienced interventional radiologist.<sup>1</sup> There are no randomized studies that have compared the various sclerosing agents. We have chosen sodium tetradecyl sulfate as it is an easily available effective sclerosant, which is well-tolerated and is without systemic side-effects.

Sodium tetradecyl sulfate is a synthetic surface-acting substance. It is a long chain fatty acid set of an alkali metal with the property of a soap. It is a clear, nonviscous liquid with low surface tension. It is composed of sodium-1 isobutyl-4 ethyl octyl sulfate plus benzoyl alcohol 2% and phosphate buffered to a pH of 7.6.

Foam Sclerotherapy is a technique that involves injecting “foamed sclerosant drugs” within a blood vessel using a pair of syringes – one with sclerosant in it and one with gas (originally air). This increases the surface area of the drug. The foam sclerosant drug is more efficacious than the liquid one in causing sclerosis, for it does not mix with the blood in the vessel and in fact displaces it, thus avoiding dilution of the drug and causing maximal sclerosant action

#### **Conclusion:**

The management of venous malformations becomes increasingly complex as they often involve adjacent neurovascular structures.

Surgery and other treatment modalities are often not feasible or not attempted alone because of the associated morbidity. Conservative management in form of foam sclerotherapy with sodium tetradecyl sulfate has been found to be an inexpensive, readily available outpatient procedure. It is quite safe and especially useful in areas where surgery is hazardous. Though it does not resolve larger venous malformations it does decrease the size and vascularity to facilitate future surgery or act as a palliative treatment.

To summarize, percutaneous sodium tetradecyl sulfate when used either alone or as adjunct to surgery is a safe, effective and inexpensive agent in the treatment of venous malformations. However proper case selection, evaluation and careful planning is necessary to reduce unwarranted risks and complications.

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## ORIGINAL ARTICLE

# Ten Year's Experience with Coronary Endarterectomy in Bangladesh: A Retrospective Study

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### Abstract:

**Objective:** In this study, we review the consequences of coronary endarterectomy (CE) with coronary artery bypass grafting (CABG), and demonstrate the outcomes of this surgical technique for patients with diffuse coronary artery disease in a single surgeon's practice.

**Methods:** We retrospectively reviewed outcome of 1473 endarterectomized coronary artery in 1189 patients with diffuse coronary artery disease (CAD), who have had experienced CE with OPCABG in the year of 2007 to 2016. CE was performed in multi-segmental diffuse CAD, or when a calcified or extremely thick plaque making anastomosis troublesome.

**Results:** Approximately 75% Coronary endarterectomy were performed in the left coronary territory and most commonly left anterior descending artery was endarterectomized (42.83%). An average of 1.24 coronary endarterectomies performed per patient. Post-operative ICU and 30-days mortality rate was 2.19%, and 0.59% respectively in CE group. Post-operative atrial fibrillation, acute MI, neurological complication and also blood transfusion was significantly higher in CE group. Following CE, five year's survival rate was 89.48% and 84.77% were free from angina at follow-up of 5 years.

**Conclusion:** Coronary endarterectomy with OPCABG is attainable and accomplishes surgical revascularization in patients; when there is no other alternative for total myocardial revascularization.

**Key words:** Coronary endarterectomy, Coronary artery disease, Coronary artery bypass graft.

[Chest Heart Journal 2017; 41(1) : 33-41]

### Introduction:

Ischemic heart disease (IHD) patients, who are referred for coronary artery bypass graft (CABG) surgery are progressively getting more complex with multiple comorbidities, and subsequently, this group of patients have diffuse coronary artery disease, which has made complete surgical revascularization more difficult. In the late 1957, Coronary endarterectomy was at first presented as a surgical option for myocardial revascularization by Bailey et al.<sup>1</sup>

Coronary Endarterectomy (CE) is the expulsion of the atheromatous plaque, and isolating the outer media and adventitia layers of arterial wall. CE is frequently important to perform total myocardial revascularization during CABG or to encourage anastomosis of severely calcified and diffuse coronary arteries<sup>1,2</sup>. Inadequate myocardial revascularization does not influence the early death rate, but rather the occurrence of restenosis which influences the long term cardiac dysfunction. These patients have more prominent repeated attacks of angina, and

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**Submission on:** 9 Nov. 2016,

**Accepted for Publication:** 25 Jan. 2017;

Available at <http://www.chabjournal.org>

more noteworthy work absence rate and require a higher number of re-interventions following CABG<sup>3,4</sup>.

This study went for assessing the consequences of coronary endarterectomy (CE) in a single surgeon's practice and to provide details regarding treatment strategies for patients having diffuse coronary artery disease.

### Patients and Methods:

Between the years 2007 to 2016, total 2647 number of patients were submitted to CABG procedure with or without CE in a single surgeon's practice. CE was considered for distal diffuse lesion, multi-segmental lesion; or when a calcified or extremely thick plaque burst, making anastomosis troublesome or hindering the distal stream. During this study, every patient was reached either during outpatient department visit (OPD) or by phone call and data was noted to data sheet. Pre-operative variables of study population are shown in Table-1.

**Surgical Technique:** All procedures were performed through a standard median sternotomy and a CPB circuit was kept on standby for all cases. Heparin was used just before completing LIMA harvest to maintain an ACT (Activated clotting time) more than 400 seconds. Almost all the operations were performed off pump CABG and a few cases required the assistance of cardiopulmonary bypass (CPB). We utilized mechanical stabilizers like suction type and the compression type; to immobilize the target coronary artery during grafting.

A conclusive decision to endarterectomize a vessel is made per-operatively. Coronary endarterectomies were performed manually by utilizing the closed methods- "slow sustain and continuous traction" of atheromatous plaque with the aid of delicate Ring Forceps, followed by reproduction with anastomosis with pre-planned graft. The arteriotomy incision was roughly 8-10mm long, however that was stretched out for another 5mm in few cases. Much consideration was provided to the entire expulsion of the distal segment, but complete proximal endarterectomy avoided due to the danger of competitive flow loss between the graft and the native artery. To ensure complete expulsion, the atheromatous plaque carefully inspected for a smooth distal taper end. In addition, back flow of blood from

the distal vessel following extraction of the atheroma is a consoling indication of adequate removal atheromatous plaque and that is special feature in OPCABG endarterectomy. In this study, longest atheroma (14cm in size) was removed from RCA and also another 10cm atheromatous plaque extracted from LAD during OPCABG (Figure-1). In early post-operative period, every patient received Heparin infusion bridging to Warfarin from the first post-operative day for next 3-6 months. In this study, a combination of Clopidogrel with Aspirin (75 mg) also used to anticipate acute thrombosis at the graft and also in the endarterectomies artery. Usually Warfarin started with 10mg daily for first 3 post-operative days followed by 2.5-5mg for next 3 to 6 months and dose was adjusted according to INR level (Targeted INR was 1.5-2.5).

We assessed the outcome of study population by survival rate, post-operative cardiovascular and neurological event, NYHA functional class, TEE (Transthoracic Echocardiography) and also CT angiogram used to demonstrate cardiac function and graft patency rate (Figure-2).

### Result:

A total of 2647 patients were undergone surgical revascularization in this review. However, 1189 patients underwent CE with CABG (Group-1), and 1458 patients underwent only CABG (Group-2) surgery. Total 1473 coronary endarterectomies were performed in Group-1, that is an average of 1.24 coronary endarterectomies performed per patient. Approximately two-third CE were performed in the left coronary territory and in 42.83% cases LAD (left anterior descending artery) required endarterectomies and grafted with LIMA (Left internal mammary artery). Used conduit for LAD graft was LIMA in 100% cases for CE with CABG group, and 99.25% in only CABG group. Mean number of graft were  $3.21 \pm 0.25$  in CE with CABG group, and  $3.02 \pm 0.15$  in only CABG group. There were 13.29% conversions to on-pump CABG using cardiopulmonary bypass in CE with CABG Group but only 3.84% conversions in only CABG Group. Operative data of study population are shown in Table-2.

There were no intra-operative mortalities in this study, however post-operative ICU mortality rate was 2.19% in Group -1, and 1.44% in Group -2. A mean of  $1.75 \pm 0.5$  units of blood was



**Table-II**  
*Operative data of study population*

Data		CE with CABG (n=1189)	Only CABG (n=1458)
Number of graft	X <sub>2</sub>	162 (13.62%)	259 (17.76%)
	X <sub>3</sub>	661 (55.60%)	951 (65.23%)
	X <sub>4</sub>	324 (27.25%)	209 (14.34%)
	X <sub>5</sub>	42 (3.53%)	39 (2.67%)
Use of Internal mammary artery (IMA)	Left IMA	1189 (100%)	1447 (99.25%)
	Right IMA	492 (41.38%)	462 (31.68%)
Use of Cardiopulmonary Bypass	YES	158 (13.29%)	56 (3.84%)
	NO	1031 (86.71%)	1402 (96.16%)
LM Disease	152 (12.78%)	173 (11.87%)	
Operative criteria	Emergency	16 (1.35%)	39 (2.67%)
	Urgent	201 (16.90%)	241 (16.53%)
	Elective	972 (81.75%)	1178 (80.80%)
Number of Endarterectomy in CE with CABG group			
Territory of endarterectomy (N=1473)	LAD	631 (42.83%)	
	OM	52 (3.53%)	
	Diagonal	298 (20.23%)	
	RCA	242 (16.43%)	
	PDA	119 (8.08%)	
	LAD + RCA	81 (5.50%)	
	LAD + Diagonal	27 (1.83%)	
	RCA + Diagonal	23 (1.57%)	

Note: LAD- Left Anterior Descending, OM-Obtuse Marginal, RCA- Right Coronary Artery, PDA- Posterior Descending Artery.

**Table-III**  
*Early post-operative variables of study population*

Variables	CE with CABG (n=1189)	Only CABG (n=1458)	P-value	
Ventilation time (hours)	9.9±1.25	9.3±1.8	<0.001	
ICU stay (hours)	36.8±6.7	36.1±5.1	0.002	
ICU mortality	26 (2.19%)	21 (1.44%)	0.148	
30 days mortality	7 (0.59%)	0 (0%)	0.004	
Hospital stay (days)	10±1.5	10±1	1.00	
Post-operative AF	187 (15.73%)	152 (10.43%)	<0.001	
Post-operative Acute MI	42 (3.53%)	19 (1.30%)	<0.001	
Renal failure	27 (2.27%)	29 (1.99%)	0.715	
Respiratory failure	16 (1.35%)	17 (1.17%)	0.811	
Neurological complications	TIA	8 (0.67%)	0 (0%)	0.002
	Psychosis	13 (1.10%)	12 (0.82%)	0.608
Use of IABP	15 (1.26%)	7 (0.50%)	0.047	
Post-operative blood transfusion (units)	1.75±0.5	1.25±0.5	<0.001	
Postoperative hemorrhagic complication	12 (1.01%)	6 (0.41%)	0.104	

P value are reached from chi square test and P<0.05 are statistically significant.

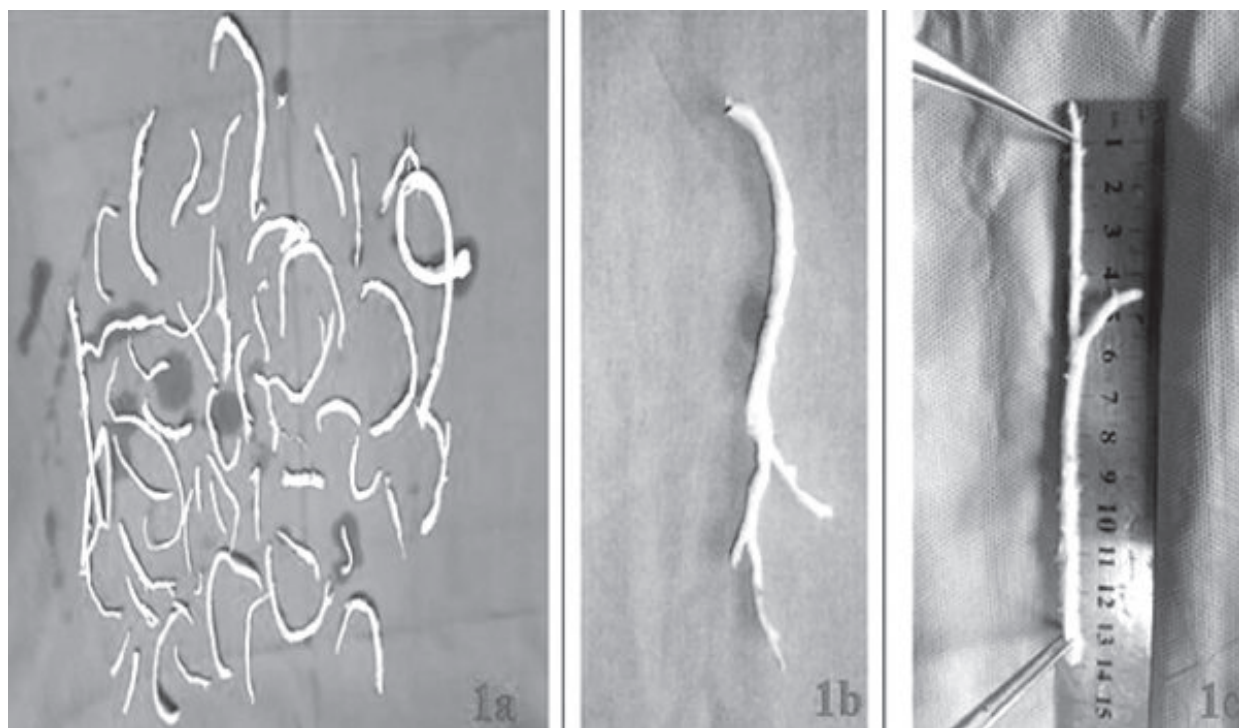
Note: ICU- Intensive Care Unit, AF- Atrial Fibrillation, MI- Myocardial Infarction, TIA- Transient Ischemic Attack, IABP- Intra-Aortic Balloon Pump.



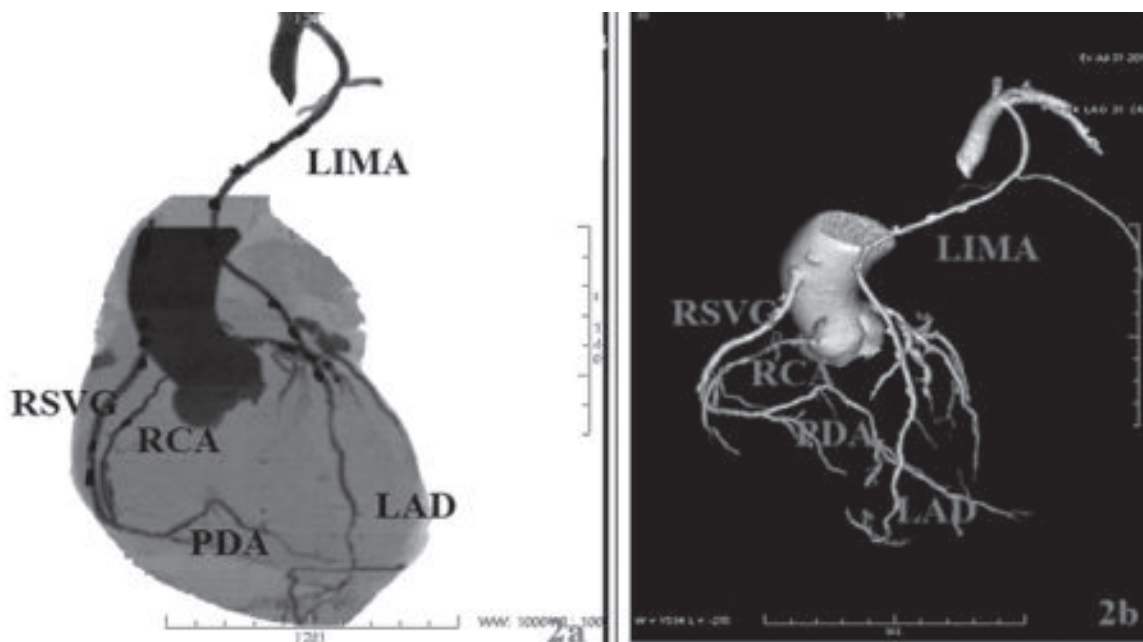
**Table-IV**  
*Long term outcome variables of study population*

Variables		Outcome at 5 years Follow up		P value
		CE with CABG	Only CABG	
Survival rate at 5 years	1064 (89.48%)	1327 (91.02%)	0.209	
Follow Up schedule	Regular	948 (89.10%)	1159 (87.34%)	0.209
	Irregular	116 (10.90)	168 (12.66%)	
NYHA Functional Class	1-2	902 (84.77%)	1147 (86.44%)	0.274
	3-4	162 (15.23%)	180 (13.56%)	
Follow up evaluation with Transthoracic Echocardiogram (TTE)				
Number of Patient	(N=865)	(N= 1043)	<0.001	
LV Ejection Fraction (EF)	EF >50%	554 (64.05%)	687 (65.87%)	
	EF 30-50%	274 (31.68%)	342 (32.79%)	
	EF <30%	37 (4.27%)	14 (1.34%)	
Follow up evaluation with CT angiogram				
Number of Patient (N=135)	(N=60)	(N=75)	0.634	
Number of graft (n=410)	n=182 Graft	n= 228 Graft		
Graft patency rate	Patent	90.70%	91.23%	
	Stenosis	6.59%	6.57%	
	Occluded	2.71%	2.20%	

P value are reached from chi square test and  $P < 0.05$  are statistically significant.  
Note: NYHA- New York Heart Association, LV- Left Ventricle.



**Figure-1:** Photograph illustrate coronary atheroma. (1a) Bunch of Coronary atheroma; (1b) Tapper end of atheroma indicates complete endarterectomy; (1c) Longest atheroma (14 cm) extracted from Right Coronary Artery.



**Figure-2:** Postoperative CT Angiogram following CE with CABG (2a) and (2b); Patent distal anastomosis graft-LIMA to LAD; RSVG to PDA graft; (A 14cm long atheroma was extracted from RCA of this patient).

### Discussion:

In this study, we evaluated the outcomes of coronary endarterectomy in CABG surgery having diffuse coronary artery disease (CAD) and shown that the complete revascularization of diffuse CAD enhanced the early and late post-operative outcomes following CABG. The mean age of study population was  $61.25 \pm 5.5$  and  $59.75 \pm 2.5$  in endarterectomy and only CABG group respectively. In this study, 1.24 endarterectomies required per patient in CE group. Out of total endarterectomies, two third endarterectomy was done in Left coronary territory, and mean graft number were  $3.21 \pm 0.25$  and  $3.02 \pm 0.15$  in CE Group and only CABG Group respectively. There were only 13.29% and 3.84% cases required cardiopulmonary bypass support in two groups respectively. Post-operative ICU mortality and 30 day's mortality rate was minimum in both study group, and all of the patients were belongs to poor LV function ( $EF < 30\%$ ) group. In this study, a mean of more blood was transfused post-operatively in CABG with endarterectomy group ( $P$  value  $< 0.05$ ). At median follow-up of 5 years, most of the patients were angina free in both group, however, the incidence of post-operative

MI and atrial fibrillation rate was higher in endarterectomy group ( $P$  value  $< 0.05$ ).

In spite of the presentation of coronary endarterectomy (CE) 60 year's prior as a strategy for treatment of diffuse coronary artery disease, its application remains controversial due to higher perioperative hazard and poor long term survival rate<sup>1,2-6</sup>. But complete myocardial revascularization for multi vessel CAD patients has been appeared to reduce the frequency of perioperative morbidity and mortality and the duration of hospital stay<sup>7-11</sup>. In a study, Jones et al. observed that complete myocardial revascularization appeared to be a most critical component influencing perioperative outcome, ventricular function, early and late post-operative morbidity and mortality<sup>12</sup>. Though LAD endarterectomy is higher hazardous, however complete revascularization of the LAD is considered as a crucial determinant of the post-operative patient's recovery<sup>8, 10-13</sup>. In this study, approximately 75% of the coronary endarterectomy was performed in the left coronary territory and outcome was satisfactory.

In a review, Eryilmaz et al. described that coronary endarterectomy yet a matter of

controversy<sup>14</sup>, which also supported by other article<sup>13-15</sup>. Closed technique for CE procedure is more straightforward, and easy to performed through small incision, and easy to reconstruction. But the potential dangers are inadequate expulsion of the plaque and the “snowplow effect,” means shearing-off of the plaque in the side branches. However, with the open technique CE, the vision is better, and that may prompt more entire expulsion of the atheroma from coronary artery and also from side branches<sup>10-15</sup>. But closed traction technique for CE was preferred because of open strategy is time consuming, required patch repair, and also myocardial contraction helps extraction of atheroma during off-pump beating heart CABG which also supported by other articles<sup>15,16</sup>. Though Adhikary et al. observed 9.9% neurological complications following open heart surgery<sup>16</sup>, but only 1.8% patient had neurological complications with complete recovery in our study, which agrees the findings of other studies also<sup>10-15,17</sup>.

In a study, Gill et al. demonstrate satisfactory early and late clinical results with luminal patency of IMA to an endarterectomized vessel compared to great saphenous vein conduit<sup>17</sup>. However, in a study Naseri et al. demonstrate higher incidence of completely blocked or significant stenosis in graft and endarterectomized artery on CT angiogram and a higher incidence of (6.8%) postoperative MI rate<sup>18</sup>. Though in our study, post-operative MI occurrence was only 3.53% and follow up CT angiogram revealed 64.44% graft patency rate at 5 year's follow-up, which is similar to other study also<sup>10,17,19-21</sup>. Moreover, in this study ICU and 30-days mortality rate was 2.19% and 0.59% respectively, and this mortality were more common among certain group of patients like after LAD endarterectomy, multi-vessel CE, and preoperative poor LV function (EF<30%), though Careaga et al. revealed a 30-day mortality of zero percent in their small series of study<sup>22</sup>. But many authors described the average frequency of early mortality after CE with OPCABG of 2-15%<sup>15-18, 20,21</sup>.

Following coronary endarterectomy, routine Heparin infusion was prescribed to prevent thrombosis in graft or native endarterectomized artery, bridging to oral Warfarin for next 3 to 6 months, which is also supported by other

articles<sup>2,10-15, 19-22</sup>. In this study, Heparin was used (usually 5000IU subcutaneously 8 hourly) in the early post-operative period, usually 3-4 hours following surgery, followed by oral Warfarin (5-10mg) till 3<sup>rd</sup> post-operative day. From 4<sup>th</sup> Post-operative day to onwards, Warfarin was used at a dose of 2.5 to 5mg for next 3 to 6 months and dose was adjusted according to INR (targeted was INR 1.5-2.5). This study also prescribed combination of Clopidogrel and Aspirin (75mg) for life long from 1<sup>st</sup> post-operative day, which also supported by other authors<sup>6,10-16,21-23</sup>.

In this study we observed that, only CABG surgery is not sufficient to provide total revascularization in presence of complex CAD with diffuse lesion, stent restenosis, and LV dysfunction, where need to do concurrent coronary endarterectomy in addition to CABG to achieved good distal run-off and better postoperative outcome. However, surgical skills and postoperative anticoagulation therapy remains the key stream in our study and CE was not found to be independently associated with mortality in the analysis for the predictors of mortality.

### **Conclusion:**

Coronary endarterectomy is feasible and a good surgical options for total myocardial revascularization in patients with diffuse coronary artery disease and should not be considered as a contraindication to OPCABG. However, surgical skill, patient's selection criteria, and postoperative anticoagulation therapy are the key words for better outcome following CE with CABG.

### **DISCLOSURE OF INTERESTS:**

No potential conflict of interest with respect to the research, authorship, and/or publication of this article.

### **CONTRIBUTION TO AUTHORSHIP:**

**Ranjan R<sup>1</sup>** - Conception, planning, Data collection, carrying out, analyzing and writing up of the work.

**Adhikary AB<sup>2</sup>** - Provide active help, guidance and valuable suggestions regarding analysis and writing up the work.

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## ORIGINAL ARTICLE

# A Study on Sarcoidosis in a Combined Military Hospital, a Tertiary Level Hospital

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### Abstract

**Background:** Sarcoidosis, a multisystem granulomatous disorder of unknown etiology, is thought relatively uncommon in Bangladesh. It is difficult to define in our country as the presentation is protean and the other granulomatous disease with similar presentations, primarily tuberculosis is very high.

**Objectives:** This cross sectional descriptive observational study comprises the presentations, assesses the pattern of variation in physical findings and organ involvement, establishes the diagnosis and observes the treatment outcome.

**Methods:** Total thirty two cases of sarcoidosis were diagnosed at the Pulmonology department of Combined Military Hospital over a three year period of time from 2014 to 2016. Diagnostic criteria included presentation compatible with sarcoidosis, findings of non-caseating epithelioid cell granulomas in cyto/histo-pathology and exclusion of other causes of granulomatous infiltration.

**Results:** Out of thirty-two patients 10 cases were found asymptomatic. Cough (72.7%) was the commonest clinical presentation. Only intra-thoracic involvement found in 09 cases. Both intra and extra-thoracic presentations were found in 08 cases and 05 cases presented with only extra-thoracic symptoms. Histopathology showed non-caseating granuloma in all cases. Diagnosis was obtained by CT guided fine needle aspiration cytology (FNAC) from mediastinal lymph node in 20 cases, lymph node biopsy by video assisted thoracoscopy (VATs)/mediastinoscopy in 07 cases, trans-bronchial FNA/bronchial biopsy in 03 cases and skin/lymph node biopsy in 02 cases. Mantoux test (MT) was negative in all cases except two borderline cases. Angiotensin converting enzyme (ACE) was found high in 17 cases. Treatment required in 11 cases by steroids. Subsequently, two cases were given disease modifying anti-rheumatic drugs (DMARDs) because of intolerance to steroid. Two cases showed progression of diseases from the time of presentation but at the end of six months follow-up all patients showed regression/remissions except one.

**Conclusion:** Due to resemblance to tuberculosis sarcoidosis may be under reported and requires larger multicenter study.

**Key words:** Sarcoidosis, Mantoux test (MT), combined military hospital (CMH), Angiotensin converting enzyme (ACE).

[Chest Heart Journal 2017; 41(1) : 42-49]

### Introduction:

Sarcoidosis is a multisystemic granulomatous disease of unknown cause that occurs worldwide

and affects people of all ages and races.<sup>1,2</sup> Sarcoidosis presents with an increased cellular immune response, particularly by CD4 cells and

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**Submission on:** 18 Sept. 2016,

**Accepted for Publication:** 25 Jan. 2017;

Available at <http://www.chabjournal.org>

macrophages.<sup>3-6</sup> Despite the fact that sarcoidosis may affect any compartment of the organism, the lungs and intrathoracic lymph nodes are the preferred locations and are affected in 90% of cases.<sup>7,8</sup> Immune mechanisms are important in the pathogenesis, assuming that various factors can trigger the cascade of immunological and inflammatory events that characterize the disease.<sup>9</sup> Genetic and racial factors can also increase susceptibility to sarcoidosis. Epidemiological studies conducted in various regions have demonstrated considerable differences in the prevalence, seasonality and clinical presentation of sarcoidosis.<sup>10-14</sup> The disease typically affects young people between 20 and 40 years of age, occurring with equal frequency in men and women.<sup>15</sup> In sarcoidosis, pattern of systemic and organs involvement varies depending on the geographic region and on the characteristics of the referral centers. Many patients with sarcoidosis are asymptomatic with incidental findings on the chest radiograph. A radiological finding of hilar bilateral adenopathies in an asymptomatic patient is highly suggestive of sarcoidosis.<sup>16</sup> The diagnosis is made on the basis of a compatible clinical and/or radiological picture, histopathological evidence of non-caseating granulomas in tissue biopsy specimens, and exclusion of other diseases that can produce similar clinical or histopathological appearances.<sup>2,17</sup> True burden of sarcoidosis in Bangladesh is not clearly known as reliable epidemiological data are not available. However, several case reports and a few large series have indeed been reported from Indian subcontinent, indicating that the disease is not as rare as is presumed.<sup>17,18,24,25</sup> The actual burden of sarcoidosis is likely to be more than what is reflected in these figures because many cases remain undiagnosed or unreported. The objective of this study is to evaluate the data obtained from a group of patients diagnosed with sarcoidosis and establishing a profile of the disease in our region.

#### **Methods and materials:**

This descriptive observational study was conducted in the department of Pulmonology, in the Combined Military Hospital (CMH), Dhaka. A total of 33 cases were selected based

on the following inclusion criteria: clinical and radiological findings suggestive of sarcoidosis; biopsy/FNAC sample demonstrating granuloma consistent with the disease and exclusion of other granulomatous disease specially tuberculosis. We excluded one patient as he got anti-tubercular treatment. We collected data regarding the following aspects: age, gender, thoracic, extra-thoracic and systemic symptoms. In all cases Mantoux test (MT), radiological findings (chest x-ray, CT-scan), serum calcium, sputum for AFB, Sputum for gene X-pert, spirometry, fiber optic bronchoscopy, FNAC/biopsy are performed. Specimens were collected for cytological or histopathological diagnosis by CT-guided FNAC, mediastinoscopy, trans-bronchial FNA/biopsy or by direct FNAC from accessible lymph node, and biopsy from skin lesion/nodule.<sup>18</sup> The basic histopathological finding is well formed non-caseating granuloma, without necrosis, with abundant epithelioid and multinucleated giant cells, surrounded by a ring of lymphocytes. In the differential diagnosis, granulomatous diseases of known causes and high prevalence in our region, such as tuberculosis and systemic mycosis, should be considered.<sup>15, 16, 17, 19</sup> The histopathological specimen examined by group of histologist in Armed Forces Institute of Pathology (AFIP). Serum levels of angiotensin-converting enzyme (ACE) are determined. Special emphasis was given to rule out other causes and also attempts were taken to see the extent of organ involvement due to sarcoidosis. ECG, Echo and MRI of brain, Schirmarr test were done in appropriate cases. All patients had a details fundoscopic examination by eye specialist.

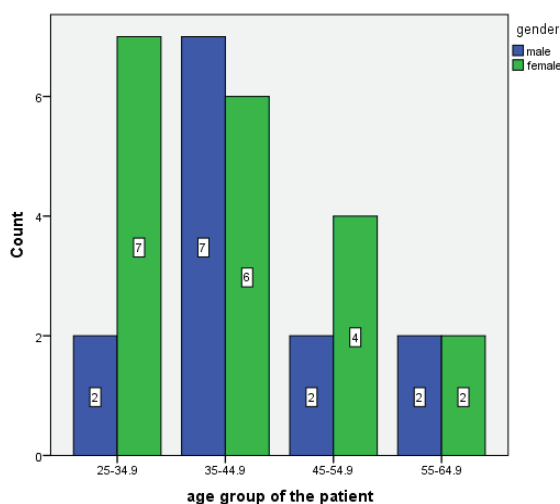
The clinical manifestations were attributed to sarcoidosis and were classified as follows: absence of symptoms (patient presented no signs or symptoms, or those found could not be attributed to sarcoidosis); pulmonary symptoms (cough, dyspnoea and chest pain); skin manifestations (skin alteration probably associated with sarcoidosis, especially erythema nodosum, skin plaque, lupus pernio); manifestations in the joints (arthralgia and swelling); systemic manifestations (fever, weight loss and night sweats); other manifestations (cardiological, ocular or central nervous system).

Radiological classifications were done by using the routine radiological classification recommended in the guidelines established jointly by the American Thoracic Society and European Respiratory Society; which included the radiological stage: 0 (normal radiological findings); I (bilateral mediastinal hilar adenopathies); II (adenopathies and pulmonary infiltrates); III (pulmonary infiltrates only); and IV (pulmonary fibrosis). All patients were kept under follow-up; most patients (stage-I and II disease) without any treatment as spontaneous recovery expected among significant number of patients.

Patients with Lofgren's presentation and involvement of vital organs received prednisolone daily until control of the symptoms and disease process and then gradual reduction done over a period of six months. The data processing and analysis was done by using the SPSS-21 version. Continuous variables are expressed as mean and standard deviations. Categorical variables were compared using the chi-square test. Some values were distributed in percentages by group.

### Results:

Among the 33 patients one case was excluded as he had received anti-tubercular treatment. The group consisted of 32 patients, 19 females (59.4%) and 13 males (40.6%), with a mean age of  $40 \pm 9.7$  years (range, 25 to 60 years) (figure 1).



**Fig.-1:** Distribution of 32 sarcoidosis patients by age group and gender.

There was no significant gender-based difference in age: men,  $41.8 \pm 10$  years; women,  $38.9 \pm 9.6$  years ( $p = 0.82$ ). At the time of

diagnosis of sarcoidosis, 10 individuals (31.3%) were asymptomatic. The frequency of symptoms was comparable between men and women (41% and 59%, respectively;  $p = 0.9$ ). There was no difference between men and women in terms of the presentation of thoracic symptoms (41% vs. 59%;  $p = 0.9$ ) and extra-thoracic symptoms (40% vs. 60%;  $p = 0.9$ ). Among the symptomatic patients, 17 (77.3%) presented with thoracic symptoms, and 05 (22.7%) presented with extra-thoracic and systemic symptoms (table-1). Exclusively thoracic symptoms were seen in 09 cases (41%) and exclusively extra-thoracic symptoms were seen in 05 cases (22.73%). There were 09 patients (41%) who presented with thoracic and extra-thoracic symptoms concomitant to systemic symptoms. Among the thoracic symptoms, cough was the most frequent, being reported by 16 patients (72.7%), followed by dyspnoea (04 patients; 18.2%), and chest pain (04 patients; 18.2%).

Among the extra-thoracic and systemic manifestations, the most frequent were arthralgia (04 patients; 18.2%); fever (02 patients; 09%); weight loss (01 patients; 4.5%); enlargement of parotid gland (02 patients; 09%), involvement of lacrimal gland (02 patients; 09%) and skin nodule, plaques and lupus pernio (04 patients; 18.2%) (Figure-2). Two patients presented with Lofgren's features (09%); whereas one patient developed fit and subsequently found to have brain involvement as evidenced by MRI features consistent with neuro-sarcoidosis. One patient (4.5%) presented with polydipsia and polyuria and found to have hypercalcemia; while another patient presented with uveitis (4.5%) along with secondary Sjogren syndrome. No cardiac and adrenal gland involvement were found in our study.

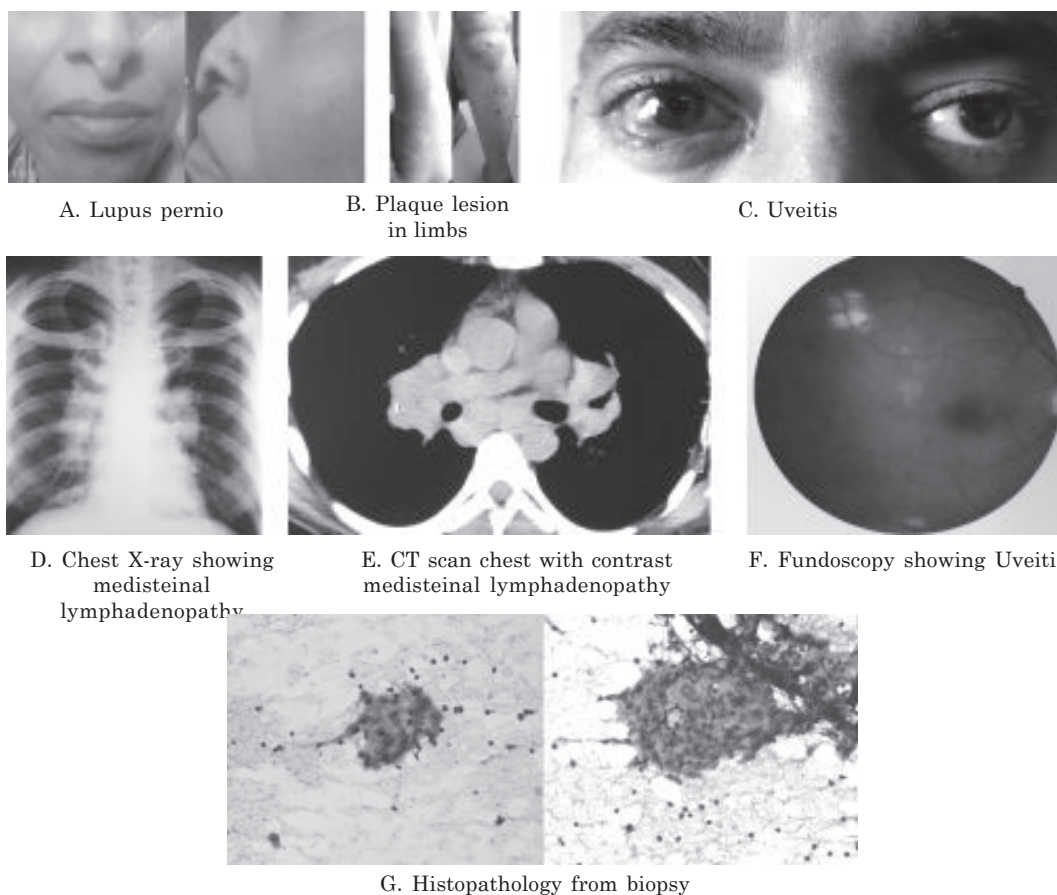
Chest X-rays and CT-scan were available for all patients ( $n=32$ ), having been taken at the time of diagnosis. Among these 32 patients, 28 (87.5%) presented with radiological stage-I, 04 (12.5%) presented with radiological stage-II (figure-3). None were classified as stage-III and IV (pulmonary fibrosis) and none of the patients presented normal chest X-rays at the time of diagnosis.



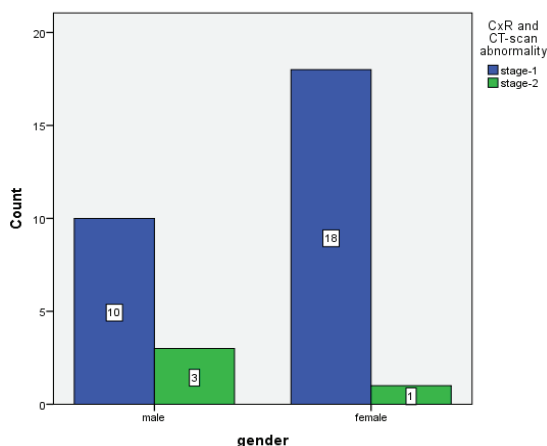
**Table-I**

*Most common sarcoidosis-related symptoms and clinical findings reported at the time of diagnosis (n = 32)*

Symptoms	All the time of diagnosis	
	Number of patient (n)	Percentage (%)
Asymptomatic patients	10	31.3
Symptomatic patients	22	68.7
Thoracic symptoms	17	77.3
Cough	16	72.7
Dyspnoea	04	18.2
Chest pain	04	18.2
Extra thoracic and systemic symptoms	05	22.7
Weight loss	01	4.5
Fever	02	9
Peripheral adenopathies	01	4.5
Arthralgia	04	18.2
Skin lesion	02	9
Lupus pernio	02	9
Hypocalcaemia	01	4.5
Neurosarcoidosis	01	4.5
Uveitis	01	4.5
Parotid gland involvement	02	9
Lofgren's	02	9
Lacrimal gland	02	9
Sjogren syndrome	01	4.5



**Fig.-2:** Photograph of clinical, radiological and histopathological findings



**Fig-3:** Distribution of the patients by radiological staging.

The specimens for cyto/histopathological examination were of intrathoracic origin in 29 patients (90.6%) and were obtained through various techniques: CT-guided FNAC in 20 (62.5%); mediastinoscopy/VATS in 07 (21.88%); trans bronchial FNAC in 02 (6.25%) (table-2). Three patients (6.12%) were diagnosed

by direct tissue biopsy from cervical lymphnode and from skin lesion. Apart from initial histological confirmation four patients had biopsy from second site: lupus pernio, skin plaque and skin nodule; that also revealed non caseating granuloma consistent with sarcoidosis. Only one bronchial mucosa showed non caseating granuloma.

MT was found negative (less than 07mm) among 30 patients (93.7%) and borderline (07 mm) among 02 (6.3%) patients. The spirometric evaluation (simple spirometry) was performed for all patients (n=32) at the time of diagnosis. Restrictive ventilatory disorders were seen in 02 patients (6.3%); obstructive ventilator disorders in 01 patient (3%) and 29 patients (90.6%) had normal spirometry. The ventilatory disorders were mild in all 03 cases and no moderate to severe ventilatory disorders were found. Serum ACE level was done in all patients (n=32) and were found raised among 17 patients (53%) and normal among 15 patients (47%).

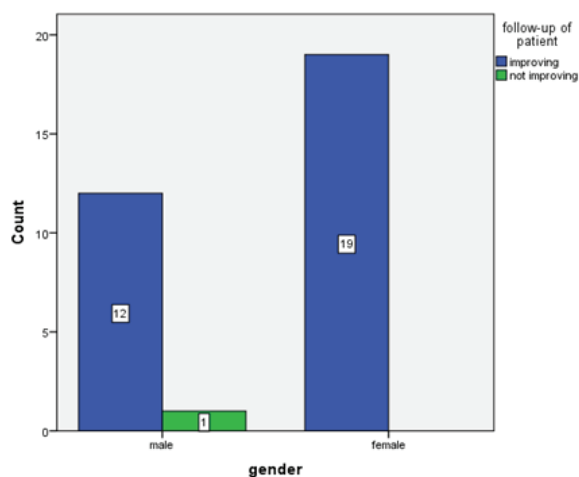
**Table-II**

*Common investigations-related findings at the time of diagnosis (n=32).*

Findings	At the time of diagnosis	
	number of patient (n)	Percentage (%)
Specimen*	32*	100
Extra-thoracic (FNAC)	03	9.4
Thoracic	29	90.6
CT-guided FNAC	21	62.5
Mediastinoscopy/VATS biopsy	07	21.88
Trans-bronchial FNAC	02	6.25
Cervical lymphnode/skin biopsy	02	6.25
MT level	32	100
Negative	30	93.7
Positive	02	6.3
Spirometry	32	100
Normal	29	90.6
Mild restrictive disorder	02	6.3
Mild obstructive	01	03
ACE level	32	100
Raised	17	53
Normal	15	47

\* Cyto/histopathological specimen showing granuloma. FNAC- fine needle aspiration cytology; CT- computed tomography; MT- Montoux test; ACE- angiotensin converting enzyme. Three patients had biopsy from skin lesion as well as CT guided FNAC

**Treatment and Outcome:**All the patients (n=32) have been followed up for at least six months. Twenty-one patients in our study remained in follow-up without medication as they belonged to stage I and stage II disease without any other vital systemic involvement. Eleven patients had received treatment (02 Lofgren's syndrome, 01 Neuro-sarcoidosis, 01 Uveitis, 02 Lupus pernio, 04 other systemic symptoms and 01 patient with intractable cough along with decrease in FEV1). As the principal therapeutic measure, systemic corticosteroid therapy was prescribed in 11 cases (34.4%) out of 32. Adverse effects that would have justified the discontinuation of the corticosteroid therapy were observed in two cases (6.3%); one developed uncontrolled hypertension with morbid obesity and other developed severe hyperglycemia. They were subsequently given disease modifying anti-rheumatic drug (DMARDs). After 03 months follow-up clinical and radiological improvement has been reported among 30 patients (93.7%). Among patients who received treatment 09 out of 11 had shown improvement (81.8%) and 02 patients (18.2%) did not show any improvement at the end of 03 months. After six months follow-up, only one patient (03%) among treatment group did not show any improvement and remaining 31 patients (97%) improved clinically and radiologically (figure-4). In asymptomatic group, mediastinal lymphadenopathy had been cleared by six months (06 patients) and by one year (04 patients). Follow up is still ongoing.



**Fig.-4:** Outcome of patients of sarcoidosis after six months follow-up (n=32).

## Discussions

In our study all the patients were evaluated by pulmonologist as well as multi-disciplinary team comprising eye specialist, rheumatologist, dermatologist, histo-pathologist and radiologist because of clinical and/or radiological presentation give rise to the suspicion of sarcoidosis. In analyzing the characteristics of the patients, the mean age of patients with sarcoidosis was 40 years which has the similarities with other studies such as conducted in USA, in which the mean age was over 40 years,<sup>21</sup> and in Netherlands, 46.7 years.<sup>10</sup> However, in studies from India, mean age is below 40 years.<sup>18</sup> A second peak has been observed in the sixth decades of life among women in Sweden and Japan which is not evident in our study; may be because of small sample size. The predominance of women over men in our sample (59.4% vs. 40.6%) is also similar to that observed in other studies from Netherlands and India.<sup>10,18</sup> The organ most affected in isolation is the lung with the incidence ranged from 50% to 95%, which has supported the present findings of 77.3% thoracic symptoms.<sup>17,18,22</sup> Pulmonary symptoms in isolation may explain delays in diagnosis, principally caused by the lack of specificity of such symptoms.<sup>6</sup> Among the extra-thoracic symptoms, studies from India showed, the most common findings were arthralgia (39%), fever (56%), skin lesion (42%), myalgia (42%) and gland involvement (43%).<sup>18</sup> In another study, done among 1026 patients by the Dutch Sarcoidian Society have reported that fatigue (71%), dyspnoea (70%), arthralgia (52%), myalgia (39%) and chest pain (27%) were the common systemic symptoms and in present series we have also seen arthralgia, fever and glandular involvement being the commonest among extra-thoracic symptoms. Though acute presentation in the form of Lofgren's syndrome is uncommon in Indian sub-continent,<sup>23</sup> we have reported two cases. Common cutaneous involvement includes erythema nodosum, lupus pernio, plaques, maculopapular lesions and subcutaneous nodules, and reported in about 11 to 34 percent of patients with sarcoidosis.<sup>23</sup> In our study, we have found two cases with lupus pernio and two with other skin lesions (12.5%). Ocular involvement is an uncommon manifestation (17%) in sarcoidosis,<sup>23</sup> and we have reported one case with uveitis. In this study, we have reported only one case of

hypercalcaemia; is also an uncommon manifestation (13%) in this sub-continent.<sup>23</sup> Neurological manifestation involvement is rare (10%) in sarcoidosis<sup>28, 24</sup> and we have reported neurosarcoidosis in one case. Presentations of radiological stage-I disease among 87.5% cases and stage-II among 12.5% cases do not correlate with findings in other studies which had reported 40 to 50% stage-I and 30% stage-II disease.<sup>4,5,18, 23, 25</sup> In this study, initial selection of the cases for further screening has been done by pulmonologist on the basis of radiological findings of hilar lymphadenopathy and may have clustered the case in stage-I and II disease. No radiological stage-III and IV disease were found. May be availability of facilities for routine screening at military hospital has made it possible to diagnose these patients at an earlier stage. Another possible explanation may be due to the fact that exclusivity of the fibrotic component could not be assessed properly as we did not performed lung biopsy at the time of diagnosis. Sarcoidosis typically has little impact on pulmonary function, and, when alterations are seen, the dysfunction is of mild intensity. Ventilatory disorders can be obstructive or restrictive, depending on the distribution of the lesions (in the airway vs. lung parenchyma) and the presence of co morbidities. Pulmonary function abnormalities are present in about 20 per cent of the patients with stage-I sarcoidosis, but occur in 40 to 70 per cent patients with stages II or III<sup>17,22</sup>. Airways involvement has been observed in about a third of the patients with sarcoidosis.<sup>17,18</sup> The spirometric findings among the cases revealed that only 03 patients showed abnormality. With only 02 restrictive and 01 obstructive ventilatory disorder of mild intensity in these series may be due to diagnosis at an earlier stage, and is supported by previous data. Negative or low MT value in the present study (93.7%) is a common finding (88%)<sup>23</sup> in sarcoidosis, and is a non-specific test commonly used to exclude tuberculosis, being the most common differential. ACE activity usually rises in sarcoidosis and has been reported among 53% of the patient in the present series, but lack of specificity and poor relation with disease progression has also been reported.<sup>23</sup> In a population based study, the incidence of sarcoidosis reported by one health organization was 21.6 women/100,000 inhabitants/year and 15.3 men/100,000 inhabitants/year.<sup>26</sup> Sarcoidosis

frequently presents with no clinical manifestations or with symptoms of mild intensity, which can delay the diagnosis. Delay in diagnosis of sarcoidosis occur more due to slow progression of disease, resemblance to tuberculosis, lack of facilities to perform invasive diagnostic procedures and lack of awareness among physicians and pathologists regarding the disease. Easy accessibility to health care facility at military hospital by army personnel and their dependents; more so easy, free/cheap available facilities for radiological and cyto/histo-pathological evaluation; probably have made possible to diagnose so many cases of sarcoidosis in this study. Radiological screening while going to serve as UN peacekeeper, thorough medical check-up during promotion, pre-operative check-up yields diagnosis of so many asymptomatic cases at Combined Military Hospital.

#### **Conclusions and Recommendations:**

Asymptomatic presentations, lack of diagnostic facilities, under reporting of diagnosed cases, remarkable similarities with tuberculosis (high burden TB country), unidentified etiopathogenesis, lack of awareness among physicians and pathologists regarding sarcoidosis have made sarcoidosis a rare disorder, though sarcoidosis presents with some clinical patterns that facilitate its recognition. Our study has the limitation of small sample size and also the inadequate follow up period. A large multi-center study is required to find out the incidence, prevalence, variation in pattern of clinical presentations and prognosis in our country.

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## ORIGINAL ARTICLE

# Surgical Treatment of Mediastinal Mass

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### Abstract:

**Introduction:** Mediastinal masses represent a group of tumours and pseudo-tumours which can involve the various compartments of the mediastinum. Surgical treatment has great role in the management of such tumours.

**Methods and Materials:** It was retrospective study. Total 39 patients were included in this study. Age range was from 30 years to 70 years. Male was 24 and female was 15. Most of the tumour was thymoma (12), thymoma with myasthenia gravis (3), Thymic carcinoma (2), Nodular sclerosing Hodgkins lymphoma (1), schawannoma (3), cystic mass (5), schawannoma with cystic degeneration (1), fibromyxoma(1), dermoid ( 4 ), teratoma( 3), Fibrosing mediastinitis in thymic mass( 1), lymphoid hyperplasia(1), malignant mesenchymal tumour(1), myxoid liposarcoma (1). Surgical exposure varies from sternotomy (22), clamshell incision (1), postero-lateral thoracotomy (14) and antero lateral thoracotomy (2). Superior Vena cava was injured in 1 case, repaired successfully by 6/0 prolene controlled by partial clamp. Some of the mediastinal mass needed careful dissection from lung, pleura, encircling distal aortic arch and proximal part of left subclavian artery, encircling left brachiocephalic vein. 1 case needed Reconstruction of sternum with prolene mesh, marsupialization was done in 2 cases, adjacent pleura, fatty tissue, part of pericardium was removed in 5 cases. Lobectomy was needed in 1 case. In 1 case Recurrence of Fibrosing mediastinitis needed steroid therapy. Extensive growth of the tumour which involve surrounding vital structures was decided not to proceed for excision in 2 cases.

**Results:** Overall Five-years survival rate was 94.87% .2 patients of the series died due to diseases process as they were advanced malignant mediastinal masses.

**Conclusion:** Surgical treatment done by cardiothoracic surgeon for mediastinal mass specially involving surrounding structures though challenging, gives good outcome.

**Key words:** Tumour, pseudo-tumour, compartment, surgery

[Chest Heart Journal 2017; 41(1) : 50-55]

### Introduction:

Mediastinal masses represent a group of tumours and pseudo-tumours which can involve the various compartments of the mediastinum<sup>1</sup>. The most common mediastinal masses are neurogenic tumors (20% of mediastinal tumors), usually found in the posterior mediastinum, followed by thymoma (15-20%) located in the

anterior mediastinum. Surgical removal of mediastinal masses usually gives good result.

### Materials and Methods:

A retrospective study was done from 6<sup>th</sup> August 2005 to 21 July 2017. Total 39 patients were included in this study. Age range was from 30 years to 70 years. Male was 24 and female was 15.

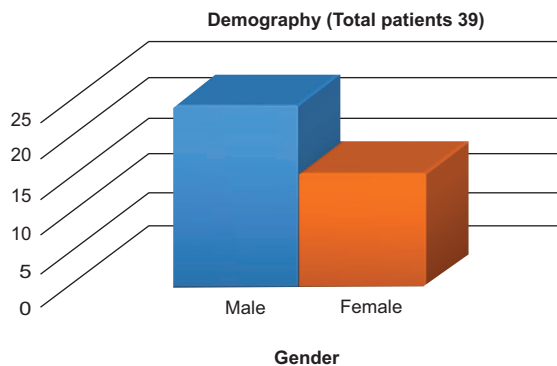
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**Submission on:** 22 Oct. 2016,

**Accepted for Publication:** 25 Jan. 2017

Available at <http://www.chabjournal.org>



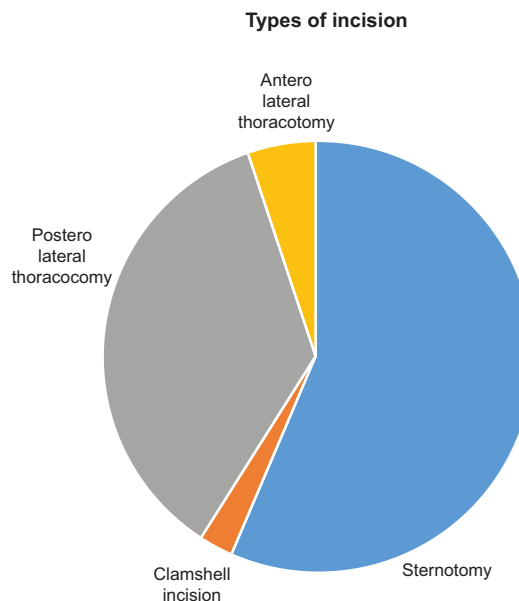
Most of the tumour was thymoma (12 cases), thymoma with myasthenia gravis in 3 cases, Thymic carcinoma 2 cases, Nodular sclerosing Hodgkins lymphoma in 1 case, schawannoma in 3 cases, cystic mass in 5 cases, schawannoma with cystic degeneration in 1 case, fibromyxoma in 1 case, dermoid in 4 cases, teratoma in 3 cases, Fibrosing mediastinitis in thymic mass in 1 case, lymphoid hyperplasia in 1 case, malignant mesenchymal tumour in 1 case, myxoid liposarcoma in 1 case.

**Table**  
*Types of tumor*

Types of Tumor	Number	Percentage
Thymoma	12	30.76%
Thymoma with Myesthenia gravis	3	7.6%
Thymic carcinoma	2	5.12%
Nodular sclerosing Hodgkins lymphoma	1	2.56%
Schawannoma	3	7.6%
Cystic mass	5	12.82
schawannoma with cystic degeneration	1	2.56%
fibromyxoma	1	2.56%
Dermoid	4	10.25%
Teratoma	3	7.6%
Fibrosing mediastinitis in thymic mass	1	2.56%
lymphoid hyperplasia	1	2.56%
malignant mesenchymal tumour	1	2.56%
myxoid liposarcoma	1	2.56%

Symptomatically most common symptom was cough and chest pain. Second most common symptom was breathlessness and heaviness over the anterior chest wall. Other complains was intermittent fever, stabbing type of chest pain, difficulty in swallowing,

dropping of upper eye lid, weight loss, anorexia, low grade fever, oral ulcer, swelling over lower part of the sternum. Double lumen endotracheal tube intubation was used in all patients and fibro-optic bronchoscope was used. Surgical exposures varies from strenotomy (22 cases) to clamshell incision in 1 case to postero-lateral thoracotomy in 14 cases and antero lateral thoracotomy in 2 case.



Superior Vena cava was injured in 1 case, repaired successfully by 6/0 prolene controlled by partial clamp. Some of the mediastinal mass needed careful dissection from lung, pleura, encircling distal aortic arch and proximal part of left subclavian artery, encircling left brachiocephalic vein. 1 case needed Reconstruction of sternum with prolene mesh, marsupialization was done in 2 cases, adjacent pleura, fatty tissue, part of pericardium was removed in 5 cases. Lobectomy was needed in 1 case. Extensive growth of the tumour which involve surrounding vital structures was decided not to proceed for excision in 2 cases.

Different type of presentation was found during operation. Large cystic mediastinal tumour was adherent with lower part of left lung and pericardium, separated carefully. Bronchial cyst was found tightly adherent to surrounding structures, excised the roof and suck out the chocolate colored thick secretion, marsupialization of excised border was done—kept the mouth wide open.

Thymic carcinoma was hard like stone adherent with the sternum, pericardium, left and right pleura, upper mediastinal surface of right lung, also encircling the left brachiocephalic vein, left lobe of the mass was removed totally along with the part of left pleura and pericardium-right lobe of the tumour was also removed as much as possible. Histopathologically was found epidermoid nonkeratinizing carcinoma.

Thymoma with Myaesthesia Gravis —total thymectomy along with removal of mediastinal fat, adjacent pleura, fatty tissue and small part of pericardium was removed.

Large fibrosarcoma (8.5 kg)—malignant mesenchymal tumour, excision of 1-4 ribs posteriorly, partial removal of left scapula and partly left pleura was excised.

Myxoid liposarcoma -adherent to great vessels pleura, chest walls, lungs, diaphragm and heart-

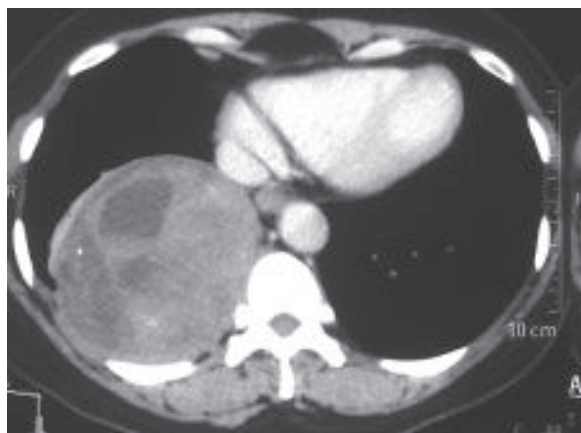
frozen section biopsy was down—malignancy—sample of tissue was then sent for histopathology.

Clamshell-curvalinear bilateral sub mammary incision was performed extending from one mid axillary line to the opposite across the anterior aspect of chest, histopathologically found mature cystic teratoma—30x10x6 cm.

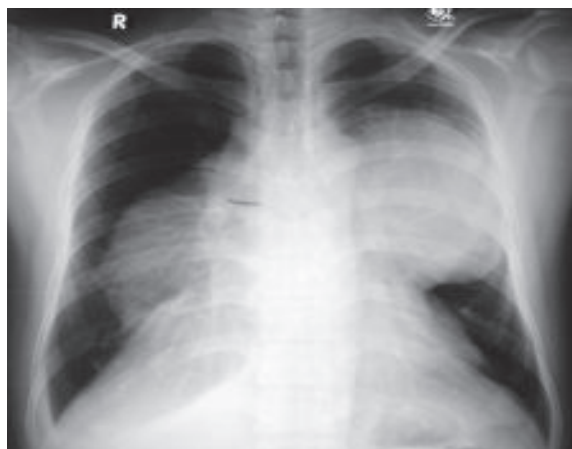
Spindle cell thymoma exposed by anterolateral thoracotomy in 70 years old gentleman, very large tumour between upper and middle lobe of right lung and in front of hilum of right lung, was firmly adherent to Superior Vena cava –small tear in Superior Vena cava repaired by 6/0 prolene. Right mediastinal mass—FNAC showed benign cystic teratoma. During operation found inoperable—frozen section biopsy showed malignancy-further surgical procedure abandoned as it was densely adherent to lung, pericardium and diaphragm



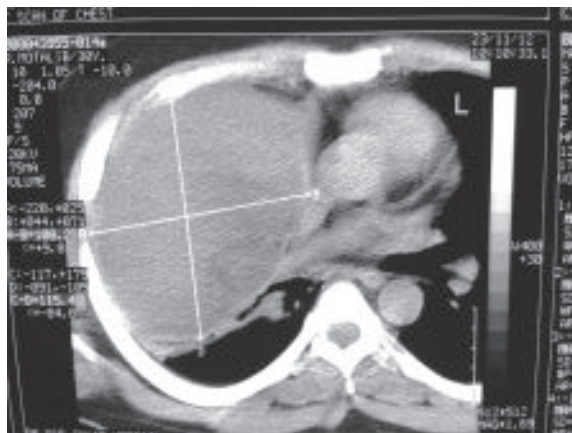
Posterior mediastinal myxoid liposarcoma



CT scan looks to be a complex hydatid cyst in posterobasal segment of right lower lobe—peroperatively found posteromediastinal cystic mass—histopathological examination showed schwannoma with cystic degeneration

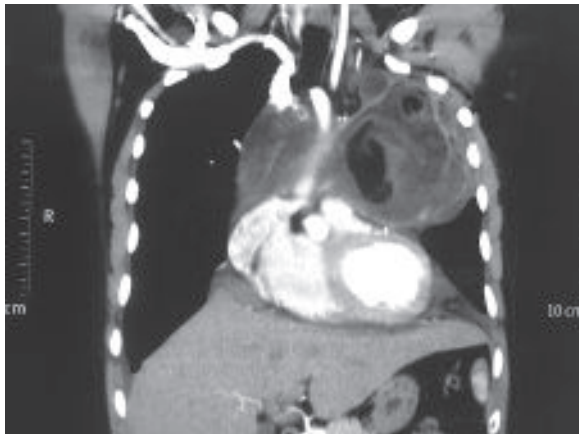


Huge mediastinal tumour —teratoma compressing both lungs and heart below



Myxoid liposarcoma—inoperable

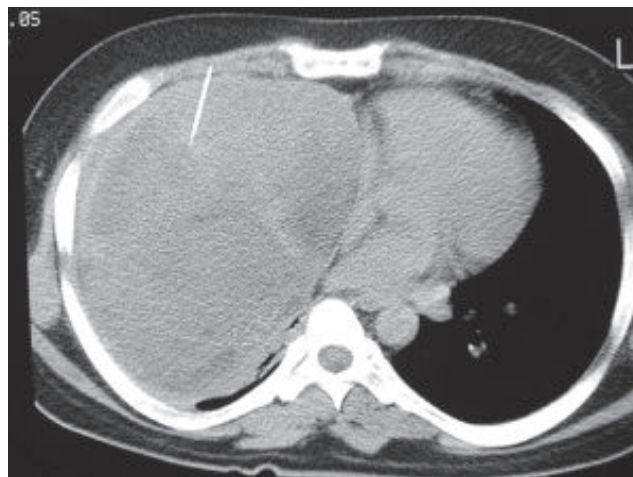




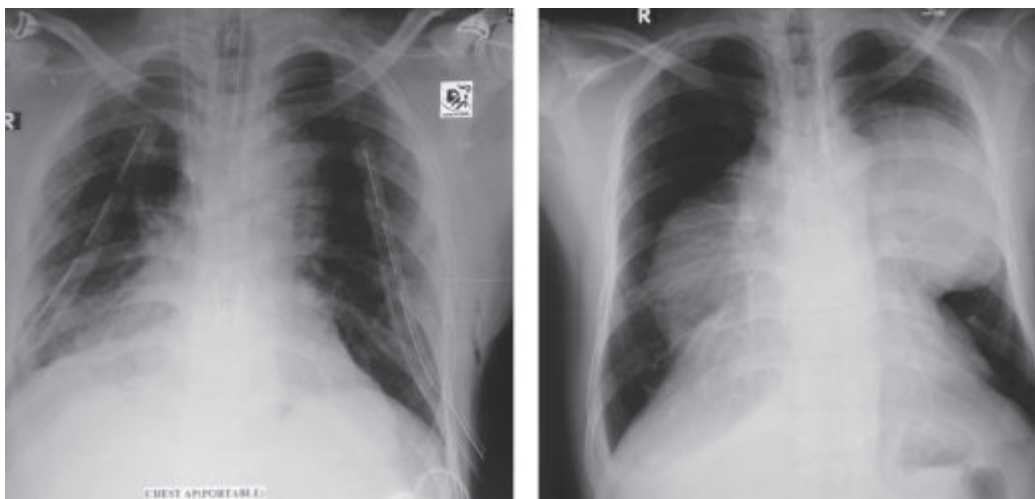
CT scan— mature cystic teratoma -heart is pushed down



Spindle cell thymoma



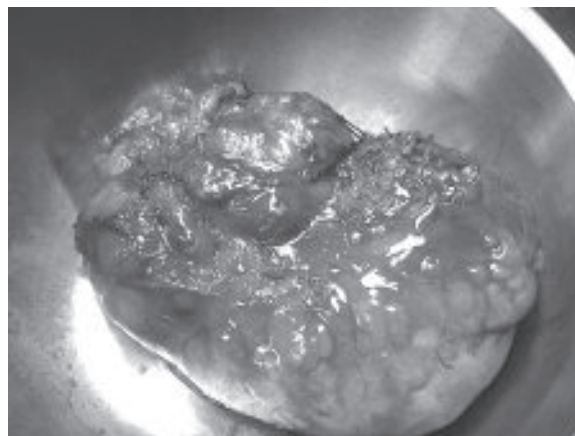
30 years gentle man:FNAC revealed Dermoid cyst, but peroperative frozen section biopsy showed myxoid liposarcoma



Preoperative (right)and postoperative(left) x-ray of huge Teratoma (mature cystic teratoma)



Mass involving nearly whole thoracic cavity—  
mature cystic teratoma



Tumour about 10 inches sized spindle cell thymoma

Overall Five-years survival rate was 94.87%. In 1 case Recurrence of Fibrosing mediastinitis needed steroid therapy. 2 cases were inoperable and died due to dieases process as they were advanced malignant medistinal mass (fibrosarcoma and liposarcoma).

### Discussion

Tumors of the mediastinum represent a wide diversity of disease states. The location and composition of a mass is vital for differential diagnosis. The most common causes of an anterior mediastinal mass include the following: thymoma; teratoma; thyroid disease; and lymphoma. Masses of the middle mediastinum are typically congenital cysts, including foregut and pericardial cysts, while those that arise in the posterior mediastinum are often neurogenic tumors. The clinical sequelae of mediastinal masses can range from being asymptomatic to producing symptoms of cough, chest pain, and dyspnea<sup>2</sup>. In our 39 patient's locations of the tumour and presentation are same type.

If left untreated, mediastinal tumors can cause serious health complications. As tumors grow, they will push against surrounding organs and tissues. Tumors that invade the heart or the vessels of the heart can cause death.

Tumors may also invade the spinal column. This may result in compression of the spinal cord.

The location of tumors within the mediastinum varies according to the age of the patient. In children, tumors are commonly found in the posterior

mediastinum. These mediastinal tumors often begin in the nerves and are typically benign. In adults, most mediastinal tumors occur in the anterior mediastinum and are generally malignant lymphomas or thymomas<sup>4</sup>.

Almost 40% of people who have mediastinal tumors experience no symptoms. Most of the growths are often discovered on a chest x-ray that is performed for another reason. When symptoms are present they are often a result of the compression of surrounding structures, such as the spinal cord, heart or the pericardium.

Fine needle aspiration cytology is considered as adequate evaluation and when done under guidance of USG/ CT the results are very good. However, core biopsies are preferable whenever lymphoma or thymoma is suspected<sup>3</sup>.

The tests most commonly used to diagnose and evaluate a mediastinal tumor include: Chest x-ray, Computed tomography (CT) scan of the chest or CT-guided needle biopsy Surgical resection is the recommended treatment Extensive growth of the tumour which involve surrounding vital structures it was decided not to proceede for excision of tumour<sup>5</sup>. While the determination for surgery is based on each patient's particular medical situation, patients diagnosed with cancerous tumors or with tumors that are invading the area surrounding the mediastinum are most likely to be candidates for mediastinal surgery.

Mediastinal tumors may reach large size before becoming symptomatic. Complete surgical excision (including adjacent invaded organs) mainly by open

technique should be the rule for these patients as there is survival benefit<sup>6</sup>. Complete excision was accomplished in all patients with benign lesions. Malignant lesions were usually partially resectable and carried a poor prognosis<sup>7</sup>. 2 patients in our study had poor outcome due to malignant mediastinal mass (fibrosarcoma and liposarcoma).

### Conclusion:

Surgical management done by cardiothoracic surgeon gives good result with good long term survival benefit. pulmonologist, cardiothoracic anaesthetist role is also vital for good outcome.

### Acknowledgement

1. Dr. Attawar Sandeep G
2. Dr. Muhammad Q. I. Talukder
3. Dr. Madhava Naik Janardhan

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## ORIGINAL ARTICLE

# Evaluation of Pulmonary Function after Surgical Correction of Atrial Septal Defect

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### Abstract:

**Introduction:** An atrial septal defect represents a communication between the left and right atrium leading to left to right shunt. It is one of the commonest varieties of congenital heart disease. With gradual increase in number & improved result, surgical correction of ASD is now most frequently performed surgery in NICVD. Although in our country no such study had yet been done on evaluation of pulmonary function after surgical correction of ASD. So, prospective study on surgical correction of ASD may show significant influence of surgery on postoperative pulmonary function.

**Methods and Materials:** This prospective, consecutive cross sectional interventional study was conducted in the department of cardiac surgery National Institute of Cardiovascular Disease (NICVD), Sher-E-Bangla Nagar, Dhaka, Bangladesh from July 2006 to June 2007. Postoperative pulmonary functions, complications were seen up to 3 months after operation.

**Results:** Pulmonary function found impaired before surgery. After surgical correction of atrial septal defect pulmonary function improved subsequently in 3 months post operative period and upper NYHA class.

**Conclusions:** Pulmonary function significantly improved after ASD closure surgery.

**Key Words:** Atrial septal defect, Pulmonary function.

[Chest Heart Journal 2017; 41(1) : 56-65]

### Introduction:

An atrial septal defect represents a communication between the left and right atrium leading to left to right shunt. It is one of the commonest varieties of congenital heart disease. It comprises about 10-15% of congenital heart disease, about 1 in 1500 live birth.<sup>1</sup>

When peripheral vascular resistance decreases beyond the neonatal period an ASD will result left to right shunting with increased pulmonary blood

flow, leading to the development of pulmonary vascular congestion or recurrent respiratory infection.<sup>2</sup> It has been suggested that increased pulmonary blood volume induces enhanced diffusing capacity and a slight decreased in lung compliance. Moreover, patient with ASD who develop pulmonary hypertension have reduced pulmonary volume & increased airway resistance. Consequently in some patient with ASD there is evidence of pre operatively impaired respiratory function.<sup>3</sup>

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**Submission on:** 9 Oct. 2016,

**Accepted for Publication:** 25 Jan. 2017;

Available at <http://www.chabjournal.org>

Management of atrial septal defect is essential, where medical treatment has got limited role and surgery plays an important role. Comparison of surgical closure with medical management, particularly when symptoms have developed, has suggested a significant survival benefit in surgically treated group.<sup>4</sup>

If untreated, increased pulmonary flow causes pulmonary hypertension and rise in pulmonary vascular resistance. Pulmonary hypertension (PH) is rare in childhood but 35 to 40% have raised pulmonary vascular resistance (PVR) by the age of 40 years. The development of pulmonary vascular disease is unpredictable and is not uniformly related to age or degree of shunting through ASD.<sup>5</sup>

Pulmonary function impairment in ASD commonly seen due to delayed presentation or late referral to the hospital. Early corrective surgery for ASD defect can prevent further progression of respiratory function impairment and pulmonary vascular change. Very rarely patient, who dies in hospital after repair of an ASD, usually has a serious coexisting condition, such as pulmonary vascular disease or old age.<sup>6</sup>

Spirometry is one of the earliest methods available and still it is probably one of the most valuable of all tests. It enables for measurement of all lung volumes and maximal breathing capacity or maximal voluntary ventilation. Modern pulmonary function equipment is extremely automated and computer assisted, computers perform all the necessary calculations and prepare the reports.<sup>7</sup>

Preoperatively, it is important to identify patient with significant restrictive or obstructive pulmonary diseases. The most common cause of preoperative pulmonary dysfunction is chronic obstructive pulmonary disease (COPD). Patients with mild COPD and few or mild symptoms generally do well through cardiac surgery. However, patients with moderate to severe obstructive pulmonary diseases who are undergoing cardiac surgery, especially those in an older age group, are at increased risk for operative mortality and postoperative complications of pulmonary dysfunction. Identification of these higher-risk patients is

important because preoperative measures to improve respiratory function may diminish postoperative complications.<sup>8</sup>

The parameter most commonly reported by authors in estimating the degree of pulmonary dysfunction is the forced expiratory volume in 1<sup>st</sup> second (FEV<sub>1</sub>). There is little consistency in the literature defining the level of abnormality for moderate to severe COPD. Values for FEV<sub>1</sub> range from <70% to <50% of the normal predicted value and/or an FEV<sub>1</sub> of <1.5L. FEV<sub>1</sub> levels as low as 1.0L would not necessarily disqualify a candidate for cardiac surgery. Clinical evaluation of lung function is important as spirometric studies.<sup>9</sup>

With gradual increase in number & improved result, surgical correction of ASD is now most frequently performed surgery in NICVD. Although in our country no such study had yet been done on evaluation of pulmonary function after surgical correction of ASD. So, prospective study on surgical correction of ASD may show significant influence of surgery on postoperative pulmonary function.

#### **Method and Materials:**

This prospective, consecutive cross sectional interventional study was conducted in the department of cardiac surgery National Institute of Cardiovascular Disease (NICVD), Sher-E-Bangla Nagar, Dhaka, Bangladesh from July 2006 to June 2007. Total number of patients was sixty. Inclusion criteria includes all patients of Atrial septal defect and FEV<sub>1</sub>, FVC & FEV<sub>1</sub>/FVC > 50% of the predicted value. Exclusion criteria are age below 10 yrs & above 40 yrs, associated valve disease, associated other congenital anomaly, ASD with coronary heart disease, ASD with reversed shunt, associated hepatic & renal dysfunction, associated cerebro-vascular disease, LVEF < 40% and patient with preexisting lung diseases like pulmonary tuberculosis & history of pulmonary lobectomy. Detailed history of each patient under study was recorded, Important and relevant findings on thorough physical examinations and investigations (Chest X-ray, Lung function test: Spiro metric variables - FEV<sub>1</sub>, FVC and FEV<sub>1</sub>/FVC ratio and Echocardiography) were collected. Postoperative variables were Chest X-ray (At 3<sup>rd</sup> POD to see postoperative complications) and 3 months after operation and Lung function test: Spiro metric

variables - FEV<sub>1</sub>, FVC and FEV<sub>1</sub>/ FVC ratio- 3 months after operation. Postoperative complications like atelectasis, collapse and pneumonia were recorded. Patients were followed up after 3 months of surgery where FEV<sub>1</sub>, FVC and FEV<sub>1</sub>/ FVC ratio were studied & these values were compared with preoperative values and also Chest X-ray, compared with preoperative X-ray. Statistical analysis of the results was done by computer software devised as the statistical packages for social solution (SPSS). The results were presented in Tables, Figures and Diagrams etc.

### Results:

At first 60 patients were included in the study out of which 2 patients were excluded due to drop out from the follow up visit. Ultimately 58 cases were enrolled in this study. All the subjects were underwent Atrial Septal Defect surgery in NICVD, Dhaka, Bangladesh during the period July 2006 to June 2007.

Among 58 patients 21 patients were male, 37 were female and male female ratio was 1:1.8 Z-test was done between the two proportions. Z=3.13, p<0.001 which was highly significant. The mean age of the study subject was 20.7 ± 7.3. The mean age of the male patients was 19.3 ± 6.6 years and that of female patients was 21.9 ± 7.8 years. It was evident that among the male patients, highest percentage 47.6% was in the age range of 10-19 years followed by 42.4 % in age range 20-29 years and 9.5% in age range ≥30 years. Whereas among the female patients highest percentage 45.9% was in the age range of 20-29 years followed by 35.1 % in age range 10-19 years and 18.9% in age range 30 years.

Analysis revealed no statistically significant mean age difference between male and female patients (p>0.05) in unpaired t-test (Table I).

Table II depict the preoperative and postoperative NYHA Functional Class in the study groups. The figure shows that the preoperative NYHA functional Class I, II, III and IV occupied 11(19.0%), 20(34.5.6%), 21(36.2%) and 6(10.3%) respectively. The post operative NYHA Functional Class I, II and III occupied 21(36.3%), 31 (53.4%) and 6(10.3%) respectively and none was found in class IV and the difference was statistically significant (p<0.05) between preoperative and postoperative period in chi square test.

Out of 58 study patients the preoperative and after 3 months operation the mean values of FVC were 2.56±0.39L and 3.15±0.17L in NYHA functional class I, 2.47±0.28L and 3.01±0.52L in NYHA functional class II, 2.37±0.49L and 2.86±0.65L in NYHA functional class III and 2.16±0.65L and 2.42±0.76L in NYHA functional class IV respectively. The differences were statistically significant (p<0.05) between preoperative and 3 months after operation in all NYHA functional class in paired t-test. (Table III)

Out of 58 study patients the preoperative and after 3 months operation the mean values of %FVC were 73.14±12.12% and 89.30±4.57% in NYHA functional class I, 72.02±6.31% and 86.65±3.53% in NYHA functional class II, 66.68±10.68% and 80.18±11.92% in NYHA functional class III and 58.82±7.67% and 66.70±10.56% in NYHA functional class IV respectively. The differences were statistically significant (p<0.05) between preoperative and 3

**Table-I**  
*Age and sex distribution of the study patients*

Age in Years	Male		Female		Total		P Value
	n	%	n	%	n	%	
10 – 19 yrs	10	47.6	13	35.1	23	41.4	0.350 <sup>ns</sup>
20 – 29 yrs	9	42.9	17	45.9	26	46.6	0.820 <sup>ns</sup>
≥30 yrs	2	9.5	7	18.9	9	12.1	0.342 <sup>ns</sup>
Total	21	100	37	100	58	100	
Mean ± SD)	19.3 ± 6.6		21.9 ± 7.8		20.7 ± 7.3		0.162

Insignificant (p > 0.05) with unpaired t-test,  
Z=3.13, significant ( p<0.001)

**Table-II**  
*NYHA class of the study patients*

NYHA Class	Pre operative (n=58)		Post operative (n=58)		P value
	n	%	n	%	
Class I	11	19.0	21	36.2	0.038 <sup>S</sup>
Class II	20	34.5	31	53.4	0.039 <sup>S</sup>
Class III	21	36.2	6	10.3	0.001 <sup>S</sup>
Class IV	6	10.3	0	0.0	0.013 <sup>S</sup>

Significant (p < 0.05) with chi square test  
s: Significant

**Table-III**  
*FVC before and after surgery according to preoperative NYHA functional class*

FVC	Preoperative mean±SD	3 month after operation mean±SD	P value
Class I	2.56±0.39	3.15±0.17	0.001 <sup>S</sup>
Class II	2.47±0.28	3.01±0.52	0.001 <sup>S</sup>
Class III	2.37±0.49	2.86±0.65	0.001 <sup>S</sup>
Class IV	2.16±0.65	2.42±0.76	0.012 <sup>S</sup>

Significant (p < 0.05) with paired t-test  
s: Significant

months after operation in all NYHA functional class in paired t-test. (Table IV)

Out of 58 study patients the preoperative and after 3 months operation the mean values of FEV<sub>1</sub> were 2.32±0.28L and 2.67±0.16L in NYHA functional class I, 2.13±0.34L and 2.56±0.44L in NYHA functional class II, 2.01±0.62L and 2.41±0.61L in NYHA functional class III and 1.67±0.82L and 2.10±0.80L in NYHA functional class IV respectively. The differences were statistically significant (p<0.05) between preoperative and 3 months after operation in all NYHA functional class in paired t-test. (Table V)

Out of 58 study patients the preoperative and after 3 months operation the mean values of %FEV<sub>1</sub> were 75.30±8.89% and 86.51±3.01% in NYHA functional class I, 70.01±9.52% and 83.89±8.22% in NYHA functional class II, 65.45±16.00% and 77.21±13.51% in NYHA functional class III and 54.72±16.45% and 65.63±16.03% in NYHA functional class IV respectively. The differences were statistically significant (p<0.05) between preoperative and 3 months after operation in all NYHA functional class in paired t-test. (Table VI)

Out of 58 study patients the preoperative and 3 months after operation the mean values of FEV<sub>1</sub>/

**Table-IV**  
*%FVC before and after surgery according to preoperative NYHA functional class*

%FVC	Preoperative Mean±SD	3 month after operation mean±SD	P value
Class I	73.14±12.12	89.30±4.57	0.001 <sup>S</sup>
Class II	72.02±6.31	86.65±3.53	0.001 <sup>S</sup>
Class III	66.68±10.68	80.18±11.92	0.001 <sup>S</sup>
Class IV	58.82±7.67	66.70±10.56	0.006 <sup>S</sup>

Significant (p < 0.05) with paired t-test  
s: Significant

**Table-V**  
*FEV<sub>1</sub> before and after surgery according to preoperative NYHA functional class*

FEV <sub>1</sub>	Preoperative mean±SD	3 month after operation mean±SD	P value
Class I	2.32±0.28	2.67±0.16	0.001 <sup>s</sup>
Class II	2.13±0.34	2.56±0.44	0.001 <sup>s</sup>
Class III	2.01±0.62	2.41±0.61	0.001 <sup>s</sup>
Class IV	1.67±0.82	2.10±0.80	0.001 <sup>s</sup>

Significant (p < 0.05) with paired t-test

s: Significant

**Table-VI**  
*%FEV<sub>1</sub> before and after surgery according to preoperative NYHA functional class*

%FEV <sub>1</sub>	Preoperative mean±SD	3 month after operation mean±SD	P value
Class I	75.30±8.89	86.51±3.01	0.001 <sup>s</sup>
Class II	70.01±9.52	83.89±8.22	0.001 <sup>s</sup>
Class III	65.45±16.00	77.21±13.51	0.001 <sup>s</sup>
Class IV	54.72±16.45	65.63±16.03	0.001 <sup>s</sup>

Significant (p < 0.05) with paired t-test

s: Significant

FVC were 88.0±7.0 and 90.1±8.5 in NYHA functional class I, 85.8±14.4% and 86.7±10.5 in NYHA functional class II, 82.5±17.70 and 85.3±10.9 in NYHA functional class III and 79.6±18.8 and 84.7±17.8 in NYHA functional class IV respectively. The differences were not statistically significant (p>0.05) between preoperative and 3 months after operation in all NYHA functional class in paired t-test. (Table VII).

Out of 58 patients the preoperative and 3 months after operation mean values of FVC were 2.41±0.45L and 2.91±0.59L respectively and the percentage of change was 20.6±12.2. The mean values of %FVC were 68.56±10.41% in preoperative period and 82.23±11.04% in after 3 months operation and the percentage of change was 20.7±12.3. The mean values of FEV<sub>1</sub> 2.07±0.54L and 2.47±0.54L in FEV<sub>1</sub> in preoperative and after 3 months operation respectively and the percentage of change was 23.4±12.4. The mean values of %FEV<sub>1</sub> 67.47±14.21% in preoperative period and 79.55±12.54% after 3 months operation and the percentage of change were 20.0±12.5%. The mean values of % FEV<sub>1</sub>/FVC were 84.72±15.94% in preoperative period and 85.20±10.36% after 3

months operation and the percentage of change was 3.8±21.1. Analysis revealed statistically significant (p<0.05) of all parameters between preoperative and 3 month after operation except FEV<sub>1</sub>/FVC in paired t-test. (Table VIII)

Out of 27 male patients the preoperative and 3 month after operation mean values were 2.55±0.55L and 3.00±0.72L in FVC, 69.79±13.15% and 81.01±11.59% in %FVC, 2.17±0.69L and 2.60±0.65L in FEV<sub>1</sub>, 66.87±16.06% and 78.78±12.72% in % FEV<sub>1</sub>, 82.69±16.02% and 87.05±7.68% in % FEV<sub>1</sub>/FVC respectively and the difference was statistically significant (p<0.05) of pulmonary function between preoperative and 3 month after operation except FEV<sub>1</sub>/FVC in paired t-test. (Table IX)

In 31 female patients the preoperative and 3 month after operation mean values were 2.30±0.30L and 2.84±0.44L in FVC, 67.50±7.30% and 83.29±10.60% in %FVC, 1.98±0.37L and 2.34±0.40L in FEV<sub>1</sub>, 67.98±12.63% and 80.21±12.54% in % FEV<sub>1</sub>, 86.45±15.93% and 83.59±12.14% in % FEV<sub>1</sub>/FVC respectively the difference was statistically significant (p<0.05) of pulmonary function between preoperative and 3 month after operation except FEV<sub>1</sub>/FVC in paired t-test. (Table X)



The change of pulmonary function after operation in male and female were  $3.00 \pm 0.72$  and  $2.84 \pm 0.44$  in FVC,  $81.01 \pm 11.59\%$  and  $83.29 \pm 10.60\%$  in %FVC,  $2.60 \pm 0.65$  and  $2.34 \pm 0.40$  in FEV<sub>1</sub>,  $78.78 \pm 12.72\%$  and  $80.21 \pm 12.54\%$  in %FEV<sub>1</sub>,  $87.05 \pm 7.68\%$  and  $83.59 \pm 12.14\%$  in % FEV<sub>1</sub>/FVC respectively. Analysis revealed no statistically significant

( $p > 0.05$ ) rate of change between male and female patients in unpaired t-test. (Table XI)

Among 58 patients, 3(5.2%) had developed Atelactasis, collapse of lung 1(1.7%), 1(1.7%) had postoperative pneumonia, and all of them were recovered after treatment. (Table XII)

**Table-VII**

*FEV<sub>1</sub>/FVC before and after surgery according to preoperative NYHA functional class*

FEV <sub>1</sub> /FVC	Preoperative mean±SD	3 month after operation mean±SD	P value
Class I	88.0±7.0	90.1±8.5	0.162 <sup>ns</sup>
Class II	85.8±14.4	86.7±10.5	0.960 <sup>ns</sup>
Class III	82.5±17.7	85.3±10.9	0.509 <sup>ns</sup>
Class IV	79.6±18.8	84.7±17.8	0.155 <sup>ns</sup>

Insignificant ( $p > 0.05$ ) with paired t-test  
ns: nonsignificant

**Table-VIII**

*Pulmonary function before and after surgery for atrial septal defect*

	Preoperative mean±SD	3 month after operation mean±SD	%of change Mean±SD	P value
FVC	2.41±0.45	2.91±0.59	20.6±12.2	0.001 <sup>s</sup>
%FVC	68.56±10.41	82.23±11.04	20.7±12.3	0.001 <sup>s</sup>
FEV <sub>1</sub>	2.07±0.54	2.47±0.54	23.4±12.4	0.001 <sup>s</sup>
%FEV <sub>1</sub>	67.47±14.21	79.55±12.54	20.0±12.5	0.001 <sup>s</sup>
FEV <sub>1</sub> /FVC	84.72±15.94	85.20±10.36	3.8±21.1	0.725 <sup>ns</sup>

Significant ( $p < 0.05$ ) with paired t-test  
Insignificant ( $p > 0.05$ ) with paired t-test  
s: Significant; ns: nonsignificant

**Table-IX**

*Pulmonary function before and after surgery for atrial septal defect in male patient*

	Before (n=27) mean±SD	After (n=27) mean±SD	P value
FVC	2.55±0.55	3.00±0.72	0.001 <sup>s</sup>
%FVC	69.79±13.15	81.01±11.59	0.001 <sup>s</sup>
FEV <sub>1</sub>	2.17±0.69	2.60±0.65	0.001 <sup>s</sup>
%FEV <sub>1</sub>	66.87±16.06	78.78±12.72	0.001 <sup>s</sup>
FEV <sub>1</sub> /FVC	82.69±16.02	87.05±7.68	0.236 <sup>ns</sup>

Significant ( $p < 0.05$ ) with paired t-test  
Insignificant ( $p > 0.05$ ) with paired t-test

**Table-X***Pulmonary function before and after surgery for atrial septal defect in female patients*

	Before (n=31) mean±SD	After (n=31) mean±SD	P value
FVC	2.30±0.30	2.84±0.44	0.001 <sup>s</sup>
%FVC	67.50±7.30	83.29±10.60	0.001 <sup>s</sup>
FEV <sub>1</sub>	1.98±0.37	2.34±0.40	0.001 <sup>s</sup>
%FEV <sub>1</sub>	67.98±12.63	80.21±12.54	0.001 <sup>s</sup>
FEV <sub>1</sub> /FVC	86.45±15.93	83.59±12.14	0.345 <sup>ns</sup>

Significant (p &lt; 0.05) with paired t-test

Insignificant (p &gt; 0.05) with paired t-test

**Table-XI***Change of pulmonary function after surgery for atrial septal defect between male and female*

	Male (n=27) Mean±SD	Female (n=31) Mean±SD	P value
FVC	3.00±0.72	2.84±0.44	0.085 <sup>ns</sup>
% FVC	81.01±11.59	83.29±10.60	0.065 <sup>ns</sup>
FEV <sub>1</sub>	2.60±0.65	2.34±0.40	0.179 <sup>ns</sup>
% FEV <sub>1</sub>	78.78±12.72	80.21±12.54	0.506 <sup>ns</sup>
FEV <sub>1</sub> /FVC	87.05±7.68	83.59±12.14	0.390 <sup>ns</sup>

Insignificant (p &gt; 0.05) with unpaired t-test,

ns: nonsignificant

**Table-XII***Postoperative complications*

Name of complications	No. of patients	Percentage
Atelactasis	3	5.2
Collapse of lung	1	1.7
Post operative pneumonia	1	1.7

**Discussion:**

This prospective, consecutive cross sectional interventional study was carried out with an objective to define the spectrum of pulmonary function test abnormalities with ASD before surgery & 3 months after correction and to make a baseline for further in depth research work on various aspect on ASD surgery and also to evaluate pulmonary function after surgical correction of atrial septal defect.

In this study out of 58 patients, 21 patients were male, 37 were female and male female ratio was 1:1.8 and the proportion was statistically significant. The mean age of the study subjects was 20.7 ± 7.3 years. The mean age of the male patients was 19.3

± 6.6 years and that of female patients was 21.9 ± 7.8 years and the mean age difference was not statistically significant (p>0.05) between male and female patients. It is nearly closer to the mean age of Saxena<sup>9</sup> and Kabir<sup>10</sup>.

In the present study the preoperative NYHA functional Class I, II, III and IV occupied 19.0%, 34.5%, 36.2% and 10.3% respectively. The postoperative NYHA Functional Class I, II and III improved 36.3%, 53.4% and 10.3% respectively and none was found in class IV. The difference was statistically significant (p<0.05). It is similar with the study of Hamano K et al.<sup>3</sup> and Ghosh et al<sup>4</sup>.

In this series the preoperative and 3 months after operation the mean values of FVC were 2.560.39L

and  $3.15 \pm 0.17L$  in NYHA functional class I,  $2.47 \pm 0.28L$  and  $3.01 \pm 0.52L$  in NYHA functional class II,  $2.37 \pm 0.49L$  and  $2.86 \pm 0.65L$  in NYHA functional class III and  $2.16 \pm 0.65L$  and  $2.42 \pm 0.76L$  in NYHA functional class IV respectively. The differences were statistically significant ( $p < 0.05$ ) between preoperative and 3 months after operation in all NYHA functional class. This finding consistent with the study of Brochu MC et al.<sup>12</sup>

The preoperative and 3 months after operation the mean values of %FVC were  $73.14 \pm 12.12\%$  and  $89.30 \pm 4.57\%$  in NYHA functional class I,  $72.02 \pm 6.31\%$  and  $86.65 \pm 3.53\%$  in NYHA functional class II,  $66.68 \pm 10.68\%$  and  $80.18 \pm 11.92\%$  in NYHA functional class III and  $58.82 \pm 7.67\%$  and  $66.70 \pm 10.56\%$  in NYHA functional class IV respectively. The differences were statistically significant ( $p < 0.05$ ) between preoperative and 3 months after operation in all NYHA functional class. This result approximating to other study by Helber U et al.<sup>13</sup>

The mean values of  $FEV_1$  in this study the preoperative and 3 months after operation were  $2.32 \pm 0.28L$  and  $2.67 \pm 0.16L$  in NYHA functional class I,  $2.13 \pm 0.34L$  and  $2.56 \pm 0.44L$  in NYHA functional class II,  $2.01 \pm 0.62L$  and  $2.41 \pm 0.61L$  in NYHA functional class III and  $1.67 \pm 0.82L$  and  $2.10 \pm 0.80L$  in NYHA functional class IV respectively. The differences were statistically significant ( $p < 0.05$ ) between preoperative and 3 months after operation in all NYHA functional class. This finding closely correlated with study of Giardini A et al.<sup>14</sup>

The preoperative and 3 months after operation the mean values of % $FEV_1$  were  $75.30 \pm 8.89\%$  and  $86.51 \pm 3.01\%$  in NYHA functional class I,  $70.01 \pm 9.52\%$  and  $83.89 \pm 8.22\%$  in NYHA functional class II,  $65.45 \pm 16.00\%$  and  $77.21 \pm 13.51\%$  in NYHA functional class III and  $54.72 \pm 16.45\%$  and  $65.63 \pm 16.03\%$  in NYHA functional class IV respectively. The differences were statistically significant ( $p < 0.05$ ) between preoperative and 3 months after operation in all NYHA functional class. A similar finding was observed by Giardini A et al.<sup>14</sup>

The preoperative and 3 months after operation the mean values of  $FEV_1/FVC$  were  $88.0 \pm 7.0$  and  $90.1 \pm 8.5$  in NYHA functional class I,  $85.8 \pm 14.4\%$  and  $86.7 \pm 10.5$  in NYHA functional class II,

$82.5 \pm 17.70$  and  $85.3 \pm 10.9$  in NYHA functional class III and  $79.6 \pm 18.8$  and  $84.7 \pm 17.8$  in NYHA functional class IV respectively. The differences were not statistically significant ( $p > 0.05$ ) between preoperative and 3 months after operation in all NYHA functional class. This finding closely correlated with study of Giardini A et al.<sup>14</sup>

In this study the preoperative and 3 months after operation mean values of FVC were  $2.41 \pm 0.45L$  and  $2.91 \pm 0.59L$  respectively and the percentage of change was  $20.6 \pm 12.2$ . The mean values of %FVC were  $68.56 \pm 10.41\%$  in preoperative period and  $82.23 \pm 11.04\%$  in after 3 months operation and the percentage of change was  $20.7 \pm 12.3$ . The mean values of  $FEV_1$   $2.07 \pm 0.54L$  and  $2.47 \pm 0.54L$  in  $FEV_1$  in preoperative and after 3 months operation respectively and the percentage of change was  $23.4 \pm 12.4$ . The mean values of % $FEV_1$   $67.47 \pm 14.21\%$  in preoperative period and  $79.55 \pm 12.54\%$  after 3 months operation and the percentage of change was  $20.0 \pm 12.5$ . The mean values of % $FEV_1/FVC$  were  $84.72 \pm 15.94\%$  in preoperative period and  $85.20 \pm 10.36\%$  after 3 months operation and the percentage of change was  $3.8 \pm 21.1$ . The mean difference of FVC, % FVC,  $FEV_1$  and % $FEV_1$  were statistically significant ( $p < 0.05$ ) between preoperative and 3 month after operation and  $FEV_1/FVC$  was not statistically significant ( $p > 0.05$ ). This finding is similar with the study by Hamano K et al.<sup>3</sup>

Among the 27 male patients in this study the preoperative and 3 month after operation mean values were  $2.55 \pm 0.55L$  and  $3.00 \pm 0.72L$  in FVC,  $69.79 \pm 13.15\%$  and  $81.01 \pm 11.59\%$  in %FVC,  $2.17 \pm 0.69L$  and  $2.60 \pm 0.65L$  in  $FEV_1$ ,  $66.87 \pm 16.06\%$  and  $78.78 \pm 12.72\%$  in %  $FEV_1$ ,  $82.69 \pm 16.02\%$  and  $87.05 \pm 7.68\%$  in %  $FEV_1/FVC$  respectively. The difference was statistically significant ( $p < 0.05$ ) of pulmonary function between preoperative and 3 month after operation except  $FEV_1/FVC$ , which was not statistically significant ( $p > 0.05$ ). On the other hand in 31 female patients in this study the preoperative and 3 month after operation mean values were  $2.30 \pm 0.30L$  and  $2.84 \pm 0.44L$  in FVC,  $67.50 \pm 7.30\%$  and  $83.29 \pm 10.60\%$  in %FVC,  $1.98 \pm 0.37L$  and  $2.34 \pm 0.40L$  in  $FEV_1$ ,  $67.98 \pm 12.63\%$  and  $80.21 \pm 12.54\%$  in %  $FEV_1$ ,  $86.45 \pm 15.93\%$  and  $83.59 \pm 12.14\%$  in %  $FEV_1/FVC$  respectively the difference was statistically significant ( $p < 0.05$ ) of

pulmonary function between preoperative and 3 month after operation except FEV<sub>1</sub>/FVC. The result of this series is approximating to another study by Hamano K et al.<sup>3</sup>

The change of pulmonary function after operation in male and female were 3.00±0.72 and 2.84±0.44 in FVC, 81.01±11.59% and 83.29±10.60% in %FVC, 2.60±0.65 and 2.34±0.40 in FEV<sub>1</sub>, 78.78±12.72% and 80.21±12.54% in %FEV<sub>1</sub>, 87.05±7.68% and 83.59±12.14% in % FEV<sub>1</sub>/FVC respectively. Analysis revealed no statistically significant (p>0.05) in rate of change between male and female patients in unpaired t-test. This finding is consistent with the study of Hamano K et al.<sup>3</sup>

In the present study out of 58 patients, 3(5.2%) had developed Atelectasis, collapse of lung 1(1.7%), post operative pneumonia 1(1.7%) all of them were recovered after treatment. These complications correlated with the study of Kabir.<sup>11</sup>

### Conclusion:

Pulmonary function found impaired before surgery. After surgical correction of atrial septal defect pulmonary function improved subsequently in 3 months post operative period and upper NYHA class.

- Pulmonary function significantly improved after surgery.
- The pulmonary functions' improvement of NYHA functional class IV was statistically significant but not up to the mark compared to others functional class.
- The rate of change in male and female were comparatively parallel.
- Postoperative complications should be prevented as possible.

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## REVIEW ARTICLE

# A Systemic Review on Coronary Endarterectomy in Ischemic Heart Disease

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### Abstract:

*Coronary endarterectomy provides complete surgical revascularization of the myocardium in diffuse and calcified coronary arteries with adequate blood flow to distal part of occluded arteries, thus improving ventricular function. Coronary endarterectomy was first described as a surgical procedure for myocardial revascularization against diffuse coronary artery disease by Baily et al. on 29<sup>th</sup> October 1956. However, the initial outcomes of coronary endarterectomy were not satisfactory but now-a-days authors have shown that coronary endarterectomy with coronary artery bypass grafting can be done safely with acceptable morbidity and mortality. Moreover, the graft patency rate on angiographic evaluation also good following Coronary endarterectomy. So that, it's time to reevaluate this old technique to fix up its indications and outcome in diffuse coronary artery disease.*

**Key words:** Coronary endarterectomy, coronary artery disease.

*[Chest Heart Journal 2017; 41(1) : 66-72]*

### Introduction:

Total myocardial revascularization is the basic principle for postoperative outcomes following coronary artery bypass graft surgery (CABG). Now-a-days, patients who are referred for coronary artery bypass graft surgery, are progressively getting more complex with different comorbidities, like DM, renal impairment, hypertension, and also peripheral vascular disease and also a large portion of this group of patients have experienced previous Coronary angioplasty<sup>1,2</sup>. Moreover, referred patients for CABG frequently have diffuse and calcified coronary artery disease (CAD), which has made complete surgical revascularization of myocardium more difficult and more complicated postoperative recovery<sup>3,4</sup>. However, up to 25%

of patients with diffuse coronary artery disease can't be treated viably and safely by conventional CABG and bringing it as incomplete myocardial revascularisation<sup>1,4,5</sup>. Inadequate revascularization does not influence the quick death rate, but rather increase the rate of coronary restenosis which adversely affect the long term cardiac function. These patients have repeated attack of angina, more awful performance in stress tests and a more noteworthy work absence rate and require a higher number of re-interventions<sup>6</sup>. That's why a couple of strategies including coronary endarterectomy, which incorporates extraction of the atherosclerotic plaque through an incision (arteriotomy) from coronary arteries have been proposed to increase postoperative outcome following CABG<sup>1,3</sup>.

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**Submission on:** 28 Aug. 2016

**Accepted for Publication:** 25 Jan. 2017

Available at <http://www.chabjournal.org>

There are very few articles revealing concurrent coronary endarterectomy with OPCABG surgery. Coronary endarterectomy was first described by Baily et al. in late 1956 as a treatment strategy for diffuse CAD without CABG<sup>1,3,6</sup>. Coronary endarterectomy procedure is as yet a matter of controversy<sup>7,8</sup>. In particular, LAD endarterectomy was considered as highly troublesome and initial perioperative mortality and myocardial ischemia rate was very high<sup>8,9</sup>. Off-pump CABG surgery for multi vessel myocardial revascularization in high risk patients has been appeared to decrease the frequency of perioperative morbidity and mortality and the duration of hospital stay<sup>10,11</sup>.

Complete revascularization of the CAD is considered as a crucial determinant of the post-operative patient's recovery<sup>12</sup>. Nevertheless, its adverse outcome with mortality and morbidity overshadowed its results in relief of angina. Hence, indications of coronary endarterectomy were limited to patients with diffuse coronary artery disease<sup>1,12-15</sup>. Since then, several studies have shown that the complete myocardial revascularization of coronary artery disease by CABG with coronary endarterectomy can be done safely and it enhanced the post-operative outcomes by improving myocardial function<sup>13-16</sup>.

### Definition and types of Coronary Endarterectomy

Coronary Endarterectomy is a surgical procedure involving the removal of atheromatous plaque, and isolating the outer media and adventitia layers of artery and reestablishing the blood flow to the distal part of the coronary artery<sup>1,17-19</sup>. A conclusive decision to endarterectomize a vessel is made pre-operatively and depends on technical contemplations. Coronary endarterectomy was considered when no sufficient segment of a vessel, providing blood supply to viable muscle with reversible ischemia, was appropriate for grafting. Endarterectomy of the unhealthy vessel was just performed when the artery was totally or almost impeded with severely calcified plaques and long segment stenosis that extends distally. There are two various approaches to perform coronary endarterectomy: Open method and Close method. But till now, it is unclear which is the perfect procedure<sup>12-20</sup>. But there is a common practice between these two strategies

to remove atherosclerotic plaque that is an arteriotomy is the basic principle in both methods<sup>10,11,15-21</sup>.

### How to perform coronary endarterectomy?

In open methods, a longitudinal incision for coronary arteriotomy is performed distal to the atheromatous plaque and extracted the atheroma from vessel, followed by reconstruction of endarterectomized site with on lay patch either with Internal thoracic artery or a saphenous venous patch<sup>21-23</sup>. However, a longitudinally opened saphenous vein can be used to repair the arteriotomy and thereafter the left internal mammary artery can be anastomosed with the vein patch<sup>5,23</sup>. Note that, this open method is time consuming but the atheromatous plaque is extracted under direct vision, so the openings of the distal end of the LAD and side branches can be checked directly. Furthermore, it can be settled to secure the distal portion of artery following an intimal dissection of the coronary artery happens<sup>2,12,24,25</sup>.

Perhaps in the close method, coronary endarterectomies were performed manually by slow sustain and continuous traction of atheroma trailed by reproduction with anastomosis with pre-planned graft<sup>2,26</sup>. Two synchronous arteriotomy can be used for coronary endarterectomy to make the framework rapid and reduce ischemic time<sup>17,27-30</sup>. The close method is shorter in duration and the graft anastomosis is easier than open method<sup>24, 30,31</sup>. But the rate of snowplow effect is more in LAD following closed method as inadequate endarterectomy is more possible<sup>30,31</sup>. Despite delicate balance of traction force, closed endarterectomy may have associated with intimal flap on distal part of endarterectomized vessel. Accordingly, obstacle of the lumen may happen distally as a result of a dissection or thrombus<sup>2,17,32</sup>.

However, regardless of the way that the open endarterectomy takes extra time; the chance of intimal flap formation is less and subsequently preventing residual obstruction. So that, some authors used the open technique for coronary endarterectomy, the quality is guaranteed<sup>23,32</sup>. Nishi et al. observe the outcome of both closed and open methods endarterectomy and finds that open method endarterectomy is superior to closed one<sup>27</sup>. Patients who experienced open

method endarterectomy had a lower perioperative morbidity and mortality. Perhaps, this group of patients have significant long term outcome.

The five-year survival rate was 74% in closed endarterectomy group but 90.7% in open method group. Also 85.2% patients of open method group are free from angina in compare to closed method where only 76.6% patients were from angina on subsequent follow up. So that, though open method is time consuming but the outcome is the better than closed one<sup>27,30-34</sup>. To ensure complete expulsion of the distal atheroma, the atheromatous plaque carefully inspected for a smooth distal taper end. In addition, back flow of blood from the distal vessel following extraction of the atheroma is a consoling indication of adequate removal atheromatous plaque and that is special feature in OPCABG endarterectomy<sup>1,10,35</sup>.

### What are the Operative Criteria for Coronary Endarterectomy?

Coronary endarterectomy is performed when the coronary vessel is extremely affected by atherosclerotic process, so that conventional CABG is insufficient to provide adequate myocardial revascularization. Also, neither immature atherosclerotic plaques nor extensive calcification are contraindications to procure a delightful anastomosis after coronary endarterectomy<sup>1,2</sup>. However, coronary endarterectomy provides more collateral circulation via side branches in case of diffuse CAD. Perhaps, if an anastomosis is performed in calcified vessel, embolization of atheromatous plaque may happen. So in presence of diffuse atherosclerosis with calcification of coronary artery, Coronary endarterectomy is required to provide good distal run off in diseased coronary artery<sup>3,4,5</sup>. Trehan and Mishra<sup>9</sup> are accounted the essential indications for coronary endarterectomy:

1. Multiple lesions in a coronary artery.
2. Diffusely disease coronary artery with calcified plaque
3. Long segment of lesion

4. Disruption of the plaque during coronary anastomosis.

However, a conclusive decision to perform endarterectomy is made per-operatively when the above criteria are noted<sup>6-17</sup>.

### Postoperative Anticoagulation therapy

Following coronary endarterectomy, in absence of endothelium, coagulation cascade become activated because sub-endothelium exposed to circulation<sup>5,10,18</sup>. So that, after coronary endarterectomy, routine Heparin infusion is prescribed to prevent thrombosis in graft or native tissue in the early post-operative period followed by oral Warfarin for next 6 months<sup>19-22</sup>. Perhaps, combination of antiplatelet and anticoagulation is also required<sup>2,23-28</sup>. Till date, there is no standard anticoagulation regimen after coronary endarterectomy exists<sup>21,29,30</sup>. Postoperatively, intravenous heparin, 75 mg combination of Ecosprin with Clopidogrel, and warfarin are used. Heparin is continued until desired warfarin effect achieved that is INR (International normalized ratio) is 1.5 to 2.5. After 3-6 months, use of warfarin is suspended for Clopidogrel and Ecosprin<sup>5,23,27-30</sup>.

### Prognosis of endarterectomy in diffuse CAD

In CAD, inadequate myocardial revascularization has been appeared to be a standout amongst the most critical components that influences perioperative outcome, ventricular function, early and late mortality<sup>20,31</sup>. However, LAD endarterectomy is thought to be higher hazardous than other territory, and in this way, it might be stayed away from by a few surgeons. Perhaps, complete revascularization of the LAD is considered as a crucial determinant of the post-operative patient's recovery and it can achieve adequate myocardial revascularization and provide better post-operative outcome<sup>17,20,32</sup>. Myocardial contraction in the LAD territory is more vigorous than the RCA region. That aides in the extraction of the distal atheromatous plaque by traction technique easily from LAD artery as compared to expulsion in the RCA<sup>14,25-32</sup>. Previously, the internal mammary artery (IMA) has been utilized cautiously as a conduit to an endarterectomized vessel as a result of concerns in regards to the



mismatch of luminal diameter. Perhaps, many authors have now detailed satisfactory early and late clinical results and luminal patency of IMA to an endarterectomized vessel compared to great saphenous vein conduit<sup>15,19,33</sup>. It has been contended that the utilization of the IMA for reproduction of the LAD graft prompts early patency, decreased perioperative myocardial dead tissue, and enhanced 5-year survival rate<sup>26,34</sup>.

In another study at the Shin-Tokyo Specialist's center and the Sakakibara Heart Association included 148 patients, who experienced endarterectomy of the LAD between 2001 and 2008<sup>2</sup>. They performed 81.8% Off-pump CABG with endarterectomy and mortality rate was 2.7%. Among them 6.1% patients were suffered from LOS (low cardiac output syndrome), 25.7% developed new onset AF, 12.2% were postoperative MI. Other co-morbidity was insignificant like 6.8% respiratory complications, 3.4% reoperation due to bleeding, 2.7% stroke, 3.4% required renal replacement therapy and 3.4% patents developed mediastinitis. Early postoperative angiography revealed 94% graft patency rate for both left internal mammary artery and LAD. Only one patient suffered from graft failure due to thrombosis and have had post-operative MI, however the early mortality was zero. Shapira et al. observed 37 patients who experienced LAD endarterectomy shows, only 2.7% intra-operative mortality rate and one case of perioperative MI were viewed<sup>17</sup>. In another study including 61 patients, Shapira et al. observed 3.3% intraoperative mortality who experienced RCA endarterectomy, and a 4.9% perioperative MI. During follow up (14–55 months) revealed one patient's death whose preoperative LVEF was 27%. The cause of death after five months of operation was due to of congestive cardiomyopathy<sup>24</sup>.

In a study, Djalilian et al. shows only 9% of their patients got angina at 46±19 months follow up, though Gill et al. observed intermittent angina in 15% of their patients at a mean follow-up of 36±16 months<sup>15,19</sup>. Post-operative acute myocardial infarction (MI) due to acute graft occlusion is a noteworthy complication following CE with an incidence rate of 1.5% to 19%<sup>19</sup>. Naseri et al. revealed a higher postoperative MI rate of 6.8% after OPCABG with endarterectomy in

completely blocked or more than >50% stenosis<sup>22</sup>. But in another study, Ranjan et al. observed that postoperative MI rate following OPCABG with coronary endarterectomy is 3.5%<sup>33</sup>. However, Christakis et al. observed 35% recurrence rate of angina at 5 years follow up in their study, which is significantly higher than other study<sup>30-34</sup>. This distinction in recurrence of side effects might be because of the especially extreme nature of the coronary disease or to inadequate revascularization accomplished.

In another study, Takahashi et al. observed the mortality rate is zero percent in a small study of CE with OPCABG and conversion of procedure to on-pump CABG rate is 8.33%<sup>34</sup>. And also post-operative morbidity was very minimum with no perioperative stroke or MI. Reoperation rate was 16.66% due to excessive bleeding and post-operative new onset atrial fibrillation rate also 16.66%. one patient developed respiratory complications who requires tracheostomy. Postoperative mean follow-up period was 24 ± 19 months; revealed neither early nor mid-term myocardial ischemia<sup>34</sup>. Naseri et al. likewise demonstrated that the intubation time, ICU stay, and the length of hospitalization was not exactly same between on pump CABG and off pump CABG with endarterectomy, which is demonstrate by other authors also<sup>22, 28-35</sup>.

However, Nishi et al. studied 127 patients with diffuse CAD who experienced CE with CABG in the year of 1994 to 2003<sup>27</sup>. This audit endorsed that coronary endarterectomy is related to an acceptable operator risk as mortality rate was 4.7%, however only 3% patients experienced perioperative MI. Infection was found in six cases, six patients required re-operation for excess bleeding, and only two patients have had TIA. Furthermore, intra-aortic balloon pump was required 17% patients and late mortality rate was 15.75<sup>27</sup>. Finally, Livesay et al. observed long term benefits following endarterectomy in their study over a period of 14 years includes a large study group about 27095 patients. Of whom 12.4% patients experienced endarterectomy and they observed that 10 year's survival rate was 68% which is very close to only CABG group 74% and this data supports the findings of other published articles<sup>13,33-35</sup>.

Although multi-vessel endarterectomy has been described but single vessel especially LAD endarterectomy is preferred as adequate stabilization of LAD is easier, can be easily visible throughout its full length and less mobilization of heart is required to achieve endarterectomy during OPCABG<sup>35</sup>. However, Erdil et al. shows that clinical and angiographic findings is excellent following right coronary endarterectomy and no additional mortality or morbidity is associated with CABG following RCA endarterectomy in relation to non-endarterectomized RCA during CABG<sup>30</sup>. However, early mortality rate is accounted to be higher after LAD endarterec-

tomy and in patients experiencing endarterectomy of more than one coronary artery<sup>18,31-35</sup>. The frequency of early mortality after CE with OPCABG of 2-15%<sup>31,33-36</sup>. However, long term graft patency rate following CE is 40%- 81.5% and single CE carries better result than multiple endarterectomy<sup>27,36,37</sup>. By the way, postoperative MI rate also high following multiple endarterectomy, no matter which artery is incorporated<sup>36-38</sup>. Here, this article will familiarize you in detail with the outcomes of a couple surveys including patients who experienced coronary endarterectomy due to diffuse CAD (Table- 1).

**Table-I**  
*Experience of Coronary endarterectomy (CE) by different surgeons.*

Author, Year	CE%	LCA%	RCA%	Perioperative MI	Early Mortality
Trehan et al. 1993	12.4%		62.9%	?	?
Shapira et al. 1988	100%	100% (LAD)	27.0%	2.7%	2.7%
Tyszka et al. 2003	11.5%	?	21.0%	3.12%	3.12%
Livesay et al. 1986	12.4%	?	83%	5.4%	4.4%
Gill et al. 1998	21.9%	?	?	21.6%	4%
Vohra et al. 2006	10.2%	17% (LAD), 1.43% (OM)	81%	4.3%	2.85%
Cooley et al. 1971	38%	?	?	?	7.7%
Qureshi et al. 1985	42%	?	72%	12%	4%
Fundaro et al. 1987	100%	72.2% (LAD)	27.2%	5.6%	0%
Brenowitz et al. 1988	50%	?	51.7%	10%	8.3%
Salerno et al. 1994	3.9%	?	61.8%	9%	4.5%
Asimakopoulous et al. 1999	4.1%	?	51.5%	5.4%	3.6%
Nishi et al. 2005	100%	55.9% (LAD), 13.7% (LCX), 5.5%(D)	41.7%	?	4.7%
Takanashi et al. 2008	100%	100%(LAD)	?	12.2%	2.7%
Schmitto et al. 2009	100%	50% (LAD),	52.8%	2.9%	4.8%
Takahashi et al. 2013	100%	100% (LAD)	?	0%	0%
Alreshidan et al. 2014	20.0%	52.6% (LAD), 18.4% (OM), 3%(D)	31.5% (RCA, PDA)	2.6%	7.9%

Note: CE-Coronary endarterectomy, LCA-Left coronary artery, LAD- Left anterior descending artery, OM-Obtuse marginal artery, D- Diagonal artery, RCA-Right coronary artery, PDA-Posterior descending artery.

**Conclusion:**

Coronary endarterectomy provides better myocardial revascularization in a patient with diffuse coronary artery disease, when CE performs in association with Coronary Artery Bypass Graft surgery.

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## CASE REPORT

# Long Segment Coronary Endarterectomy from Left Anterior Descending Artery with Modified on-lay Patch Graft by Internal Thoracic Artery

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### Abstract:

*Despite the existence of controversial debates on the efficiency of coronary endarterectomy (CE), it is still used as an adjunct to coronary artery bypass grafting (CABG). This is particularly true in patients with diffuse calcified coronary artery disease. Given the improvements in cardiac surgery and postoperative care, as well as the rising number of elderly patients with numerous co-morbidities, re-evaluating the merits and demerits of this technique is needed. We present one such patient referred to us as a case of severe diffuse Left Anterior Descending Artery (LAD) lesion with Triple Vessel Disease (TVD) with chest pain in minimum daily activities. After evaluation surgical revascularization was done by coronary endarterectomy in addition to off pump CABG. A long segment (9cm) atheromatous plaque was removed from LAD and reconstruction was done by modified On-Lay patch with left internal mammary artery. His post-operative period was uneventful and patient was discharge from hospital on 10<sup>th</sup> post-operative day. Follow up on 30<sup>th</sup> post-operative day demonstrate improved LV systolic function. Complete myocardial revascularization is the main stays of treatment modalities for diffuse CAD and coronary endarterectomy can be perform safely.*

*Keywords: Coronary endarterectomy, Left Anterior Descending Artery, Modified On-lay Patch graft.*

*[Chest Heart Journal 2017; 41(1) : 73-75]*

### Introduction:

Endarterectomy is the removal of the atheromatous plaque, dissecting and separating the external media and adventitia layers, thus restoring the lumen to the artery<sup>1</sup>. In patients with diffuse coronary disease, characterized by long segments impaired by atherosclerosis, endarterectomy of the coronary arteries (ECA) is often necessary to perform complete coronary artery bypass grafting (CABG)<sup>2</sup>. Coronary artery

endarterectomy with coronary artery bypass grafting for diffuse coronary artery disease has been associated with increased morbidity and mortality. We evaluated our experience to redefine the role of coronary endarterectomy for diffuse coronary artery disease<sup>1,2</sup>.

### Case Presentation:

On 12<sup>th</sup> May 2017 one patient came to us with the diagnosis of severe diffuse Left Anterior

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**Submission on:** 27 Aug. 2016

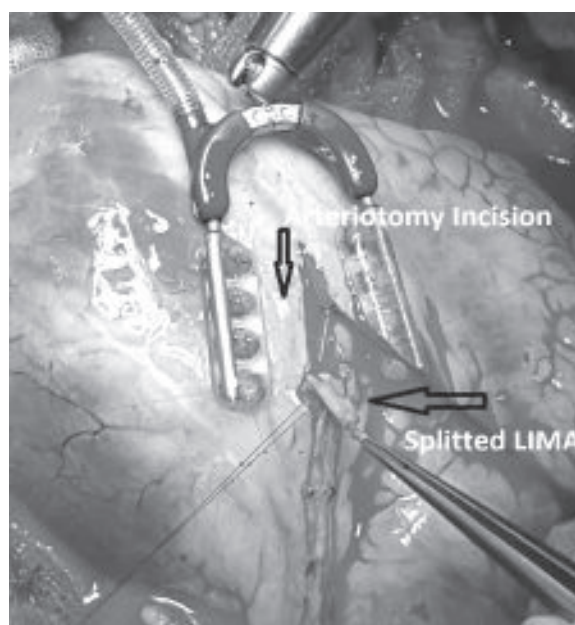
**Accepted for Publication:** 25 Jan. 2017

Available at <http://www.chabjournal.org>

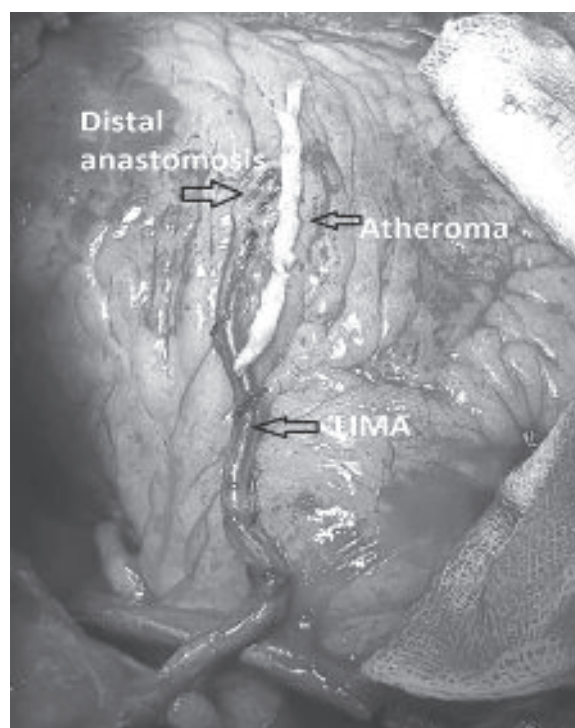
Descending Artery (LAD) lesion with Triple Vessel Disease (TVD) with Ejection fraction (EF) 23% with diabetes mellitus (DM) with ongoing chest pain with minimal exertion. Preoperative Echo findings: LVIDd-60mm, LVIDS-54mm, EF-23% and other laboratory investigation report for GA fitness was within normal range. Patient undergone OPCABG on 15<sup>th</sup> may 2017, at Al-Helal Specialized hospital, Mirpur-10. Under GA with all aseptic precautions with mid sternotomy LIMA (skeletonised) along with left great saphenous vein were harvested. Two proximal anastomosis of RSV to aorta were done with side biting clamp. With full heparinization 10mm arteriotomy in LAD was done and no blood flow was found due to presence of mature atheromatous plaque. Then arteriotomy extended about 15mm distally to the previous site which also revealed mature atheroma. So, we decide to perform endarterectomy and 9cm atheroma was extracted from LAD in open technique using ring tip forceps (Figure-1). After removal of the atheroma, there were good back flow of blood was seen. Then LIMA was splitted according to the arteriotomy size & anastomosed distally to LAD (2.5mm long intracoronary shunt was used) (Figure-2). Distal anastomosis of RSV was done distally to OM<sub>2</sub> (1.75 mm). Another RSV was anastomosed distally to RCA (1.75 mm) after atherectomy. All anastomosis was done on beating heart and Heart was stabilized with Starfish and Octopus Stabilizer during distal anastomosis. After achieving haemostasis chest was closed leaving with one RV epicardial pacing wire, two drain tube in situ attached with under water seal drainage. Postoperatively we gave Heparin subcutaneously for 72 hours with the aim of prevention of thrombus burden in native artery as well as graft site followed by Tab. Warfarin 2.5mg orally concurrently and advised to continue Tab. Warfarin for 6months postoperatively along with Clopidogrel and Ecosprin.

His postoperative period was uneventful and patient got discharged from Hospital on 10<sup>th</sup> Post-operative day. On day of discharge 2D-M mode ECHO Showed: LVIDd-58mm, LVIDS-56mm, EF-24%. On 1<sup>st</sup> follow-up visit, on 30<sup>th</sup> postoperative day 2D-M mode ECHO Showed: LVIDd-55mm, LVIDS-55mm, EF-25%. Patient was free from cardiac pain postoperatively to

till now and now he can walk up to 3km in 45minutes. Patient was advised to take next follow up visit after 3 months postoperatively.



**Fig.-1:** Extended arteriotomy (25mm) involving diffuse calcified LAD artery with modified on-lay patch graft by Left internal mammary artery (LIMA) (Arrow marked).



**Fig.-2:** LIMA to LAD distal anastomosis site with removed atheroma specimen (9cm).

**Discussion:**

Diffuse coronary disease can make adequate surgical treatment difficult or even prevent it totally. In these cases, conventional CABG does not supply an adequate flow through the entire vessel, resulting in incomplete CABG<sup>1</sup>. Incomplete CABG does not affect the immediate mortality rate, but the incidence of arterial reoperations with significant obstructions in vessels, which irrigate the viable myocardium, negatively affects long-term cardiac events. These patients have greater recurrence of angina, worse performance in stress tests and a greater work absenteeism rate and require a greater number of re-interventions, besides the better survival rate of completely grafted patients<sup>2,3,4</sup>. The preliminary results with ECA reflect the experience of the 60s and 70s and demonstrate a greater morbidity and mortality in the immediate post-operative period, making its merit controversial<sup>4,5,6,7,8</sup>. With technical improvements and a greater operative indication for patients with diffuse coronary atherosclerotic impairment, the role of endarterectomy is being reassessed<sup>5,7,9</sup>. In Bangladesh 14 cm long atherectomy done from RCA which is the longest atheroma recorded till date<sup>10</sup>.

**Conclusions:**

With the increasing incidence of diffuse coronary artery disease and improving results of coronary endarterectomy, it is vital for cardiac surgeons to have coronary endarterectomy in their armamentarium to achieve complete coronary revascularisation.

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## CASE REPORT

# Arterio-Venous Malformation- A Case Report

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### Abstract:

*An adult female with sudden attack of 2 episodes of seizures came to the hospital semiconscious. NECT was done and diagnosed as ICH-frontal lobe. Subsequently MRI and MRA were done and differentials were Cavernoma, AVM and Neoplastic lesion. Conservative treatment was given and patient was advised for DSA after 4 weeks. After DSA the lesion was diagnosed as AVM. Surgically the lesion was removed and histopathology confirmed the diagnosis.*

*Key Words: AVM, Cavernoma, Hemorrhage, DSA, CTA, MRA.*

*[Chest Heart Journal 2017; 41(1) : 76-82]*

### Introduction:

A brain Arteriovenous Malformation (AVM) is a tangle of abnormal blood vessels in the brain or on the surface bypasses normal brain tissue diverts direct blood from the arteries to the veins. Brain AVMs occur less than 1% of the general population. It is estimated that about one in 200000 people may have AVM. The arteries are responsible for carrying oxygenated blood for the metabolic demands of the brain and the veins carry deoxygenated blood from the brain to the heart while AVM disrupting this vital pattern.

### Case report:

A young physician of 25 years came to the emergency room with history of fever and convulsion of 2 times. Patient was febrile for last 3 days and fever was low grade and continuous in nature, not associated with chill and rigor or photophobia. Later she had 2 episodes of generalized convulsion. She also had loss of history of brief period of loss of consciousness during convulsion. She had no history of such episode previously. No history of trauma or limb weakness. General and systemic examination revealed no abnormality except for right sided grade

1 facial weakness. Her routine hematological and biochemical reports were within normal limit. The CT brain showed left frontal ICSOL with tumor hemorrhage with perilesional edema. MRI with contrast was done and showed blood in the left frontal area didn't have significant contrast enhancement. She was put on anticonvulsant. She had no seizure during the hospital stay and she was afebrile. She was discharged with an advice to do Digital Subtraction Angiography 1 month later to confirm the diagnosis. DSA was done and a cortical AVM was found in the left frontal area, flow of which was moderate. The flow came from M4 branch and draining vein went through bridging vein SSS. The size of the AVM was approximately 2\*2 cm. there was no flow related or intra nidal aneurysm but there was long subarachnoid venous course. The impression was Spetzler and Martin grade 1 AVM in left frontal cortex. A left frontal craniotomy and total excision of the arteriovenous malformation was done. She had satisfactory postoperative period without recruitment of any new neurological deficits. She had no seizure, fever or weakness of any part of the body. She was discharged with the advice of doing another DSA three months later.

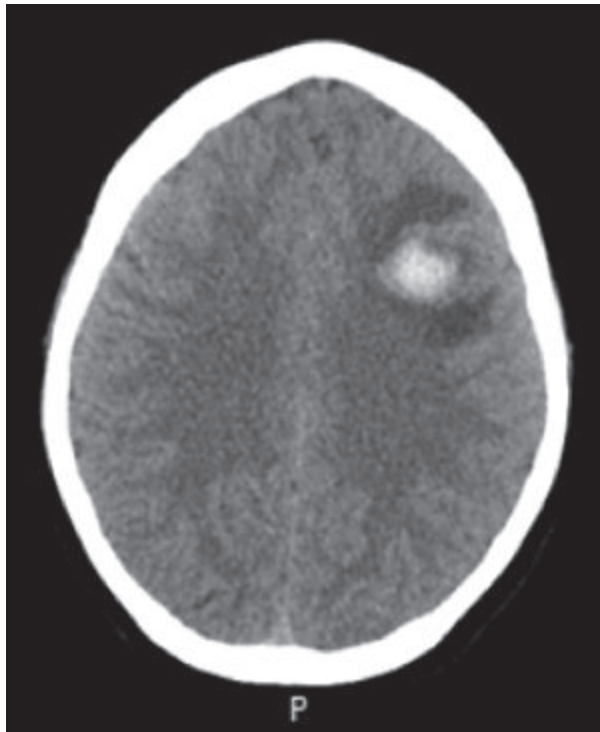
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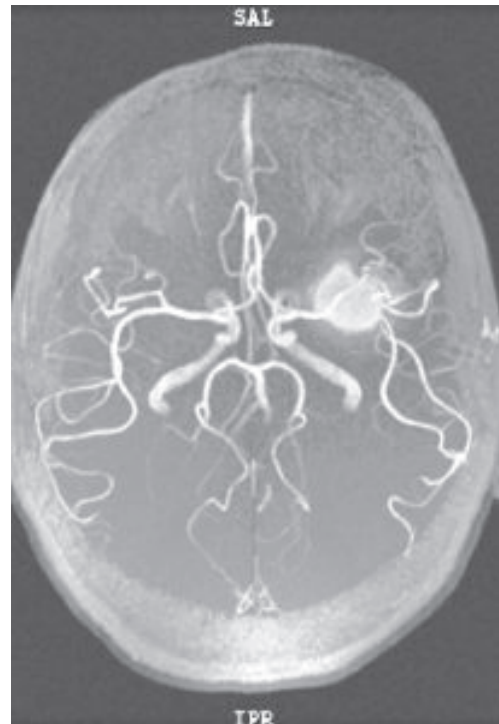
**Submission on:** 23 Nov. 2016

**Accepted for Publication:** 25 Jan. 2017

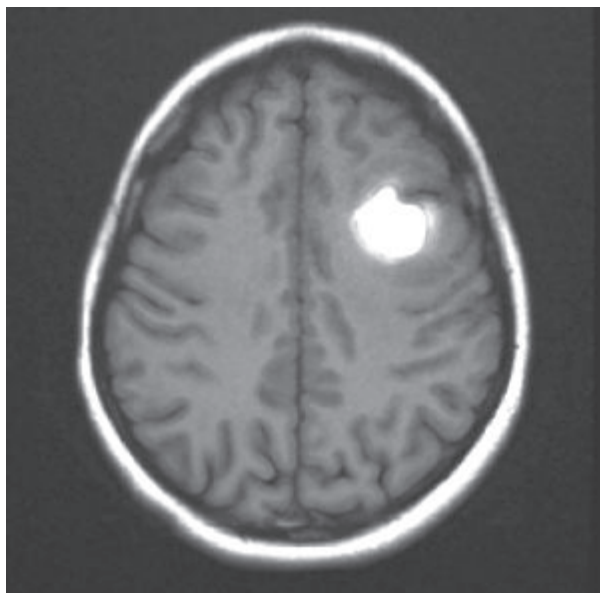




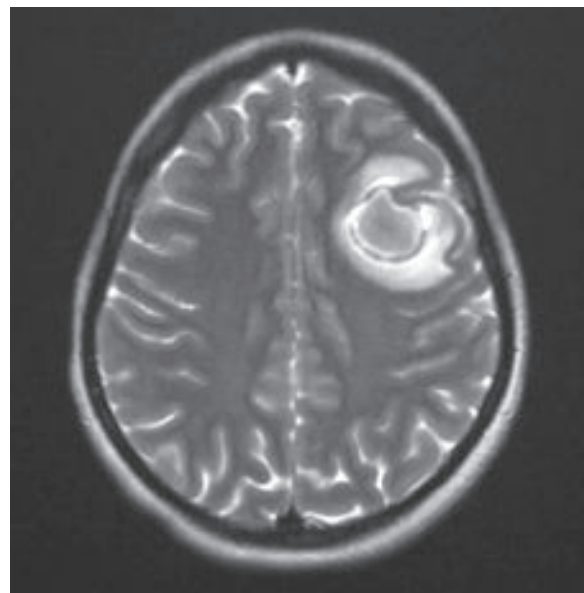
NECT scan of Brain showing Hyperdense lesion with Perilesional oedema



MRA showing mid segmental proximal left MCA is not well visualized and pushed by the ICH in left frontal lobe with crowding of aberrant vessels in the vicinity of ICH and Prominent vein draining into Superior Sagittal Sinus.



MRI showing Mixed Signal Intensity Lesion having hypointense core bordered by hyperintense rim in T1WI and hypotense in T2WI with Perilesional oedema and compression of the ipsilateral sulci.





DSA showing cortical AVM in Left Frontal Lobe



DSA showing cortical AVM in Left Frontal Lobe

**Discussion:**

AVM stands for Arteriovenous Malformation. An AVM is a tangle of abnormal and poorly formed blood vessels (arteries and veins). They have a higher rate of bleeding than normal vessels. AVMs can occur anywhere in the body. Brain AVMs are of special concern because of the damage they cause when they bleed.

AVM arises about 3 weeks after conception at the time when blood vessels are dividing into vein and arteries.<sup>1</sup> Recent studies have suggested AVMs are dynamics and have the ability to grow, regress and regenerate following obliteration by surgery or radiosurgery. Currently it is thought that the altered expression of more than 900 genes are involved in the pathogenesis of AVM.<sup>2</sup> AVM have been associated with aneurysm in 10-15% of patient group depending of the type of angiographic techniques employed.<sup>3</sup>

Vascular malformations are of 2 types.

- A. Low flow varieties LFV: capillary, venous and lymphatic malformation
- B. High flow varieties HFV: AVMs and arteriovenous fistula

Location of AVM: (5)

- Supratentorial 85%
- Infratentorial 15%

Incidence:

- Solitary AVM 98%
- Multiple 2%

Associated abnormalities-

- Flow related angiopathy secondary to endothelial hyperplasia
- Flow related aneurysm:
  - o Intranidal
  - o Intrapedicular
- Remote aneurysm: Hemodynamically unrelated to aneurysm

Classification:

1. Compact (Glomerular) Nidus: Abnormal vessels without any interposed normal brain tissue.
2. Diffuse (Proliferative) Nidus: No well-formed nidus is present with functional neuronal tissue interposed amongst the anomalous vessels.

Basic pathological characteristics of AVM: it demonstrates variable histology that may reveal capillaries, venules and arterioles that may exhibit hypertrophy, wall thickening and possibly dystrophic calcification all within a densely fibrous or fibromyxomatous background.<sup>10</sup>

The patient of an AVM at which rapid arterial shunting passes into an arterialized vein acting as a low pressure cell is termed the nidus.<sup>16</sup> The increased shunting into the nidus lead to arterial and venous hypertrophy that can compress erode infiltrate or destroy adjacent normal structures.<sup>17,18</sup>

Spetzler Martin AVM grading system: It is a method of estimating the mortality and morbidity of surgical resection to guide treatment recommendation. It allocates points for various features of intracranial AVM including size, eloquent location and venous drainage.<sup>23</sup>

Size of the nidus	
1 point	Small < 3 cm
2 point	Medium 3-6 cm
3 point	Large > 6cm
Eloquence of adjacent brain:	
0 point	Non eloquent ( frontal and temporal lobe, cerebral hemisphere)
1 point	Eloquent ( sensory, motor, language, visual cortex, hypothalamus, thalamus, brain stem, cerebellar nuclei or region directly adjacent to these structures

Venous drainage:	
0 point	Superficial only
1 point	Deep

The Spetzler Martin Grading was originally validated in a study of 100 consecutive patients treated with microsurgical excision of AVMs. Morbidity rates were as follows:

Grade	Morbidity %
1	0
2	2.5% minor deficit
3	12% minor deficit, 4% major deficit
4	20% minor deficit, 7% major deficit
5	19% minor deficit, 12% major deficit
6	Used to describe inoperable lesion

The score correlates with operative outcome.

**Investigation:** The first imaging study that is performed in patients with a suspected AVM is usually a computed tomography (CT) or magnetic resonance imaging (MRI) scan. These studies are good for depicting AVMs and they are relatively noninvasive, only requiring an injection of contrast material into a small vein. Overall, arterio venous malformations are best imaged by using MRI, which can uniquely show these lesions as a tangle of vascular channels that appear as flow voids. Nonenhanced CT is superior for visualizing the small foci of calcification often associated with arteriovenous malformations, and it may also delineate hyper attenuating serpiginous vessels that constitute the nidus.

Non enhanced CT scan is valuable for demonstrating the extent of acute hemorrhage and hydrocephalus. Contrast-enhanced CT shows enhancement of the typical vascular channels. Magnetic resonance angiography (MRA) or CT angiography (CTA) may be adequate for initial or follow-up evaluation of an arterio venous malformation.

CT scan is an excellent examination for detecting cerebral hemorrhage, but it can miss an underlying AVM. AVMs are typically iso attenuating relative to normal parenchyma and, therefore, can be overlooked, particularly if a contrast agent is not administered. In an emergency setting, the administration of an iodinated contrast agent is typically deferred in favor of patient stabilization. Contrast-enhanced CT scanning also poses an inherent risk of radiation and, because of its cost, MRI may be a better screening examination for AVM in the general population. Contrast-enhanced CT scanning is performed to detect cerebral AVM, however, when MRI is contraindicated or otherwise not feasible.

MRI is excellent for demonstrating the AVM nidus and abnormal flow voids typical of an AVM; however, in acute cerebral hemorrhage, compressed AVMs may no longer demonstrate flow and may, therefore, be overlooked. This may lead to the need for serial MRI studies to search for an underlying cause of cerebral hemorrhage not shown on a single MRI study. MRI can cause underestimation of the

number of feeding arteries and associated aneurysms, which might also be missed. Furthermore, MRI can have a relatively poor sensitivity in detecting dural malformations. Gadolinium-based contrast material may be needed to demonstrate abnormal vascular channels.

Digital subtraction angiography (DSA) remains the criterion standard for characterization and delineation of brain and spinal AVMs. Angiography is a dynamic real-time study that not only demonstrates the presence or absence of an AVM, but also shows vascular transit time. Diagnostic angiography is uniquely able to delineate the size and number of feeding arteries, and it can define the pial, dural, or mixed origin of the AVM.

Angiography can be used to measure the size of the AVM and judge the compactness of the nidus. Furthermore, angiography can be used to evaluate the venous drainage pattern (superficial, deep, or mixed). In addition, angiography frequently depicts associated risk factors for hemorrhage, including aneurysms and venous stenosis. Planning an angiography is a vital step in both interventional neuroradiologic and neurosurgical evaluation of patients with AVM.<sup>11</sup>

Angiography can reveal certain features that are believed to correlate with an increased risk of hemorrhage. These features include the presence of associated intranidal, remote, or pedicular aneurysms; central or deep venous drainage; stenosis of a draining vein; and a periventricular or intraventricular location.

**Conclusion:** DSA remain the gold standard for the diagnosis of intracranial AVM but is invasive. CT scan easily identifies intracerebral hemorrhages, raising suspicion of AVM in a younger person or a patient without clear risk factors for hemorrhage; however, this modality can identify only large AVMs with the disadvantage of radiation whereas existing MRA is suboptimal for assessing the hemodynamic information with a temporal resolution of 50-100 for the evaluation of AVMs and can complement existing methods such as DSA, TOF MRA, DMRA, and BDCT angiography.

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# INSTRUCTION TO AUTHORS ABOUT UNIFORM MANUSCRIPT WRITING

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